CHICAGO NATURAL HISTORY MUSEUM
Bulletin
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January 1964

Pal-dan Ye-she,
a leading dignitary of the Lamaist church of Tibet, who died in Peking in 1780 while visiting that city as the honored guest of the Emperor of China. This portrait statue, executed in cloisonne enamel, is displayed in the Museum's new hall, "China in the Ch'ing Dynasty," opening this month.

SHOUT
SHARE
IT

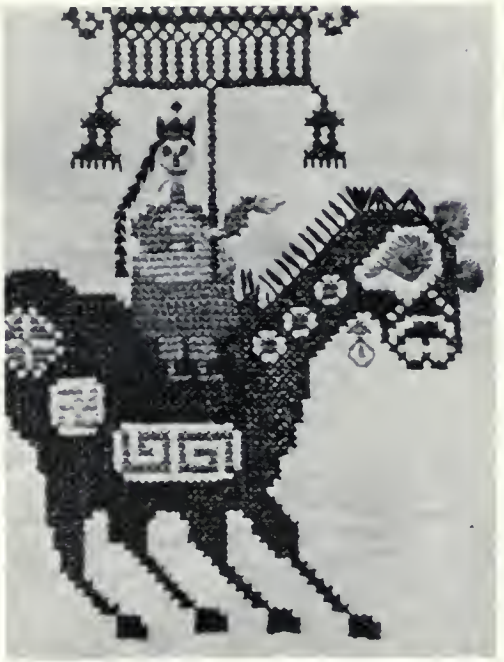
China

In the Ch'ing Dynasty,

LAO-TZU BLESSING
A WATER BUFFALO
(BRONZE)

EXHIBIT DESIGNER:
THEODORE HALKIN

PHOTOGRAPHS (INCLUDING COVER):
JOHN BAYALIS AND
HOMER V. HOLDREN



CROSS STITCH EMBROIDERY

SHADOW PUPPET

COURT
FAN

THE China known best to that small group of Westerners who proudly called themselves "old China hands" is recreated in a new exhibition hall opening at Chicago Natural History Museum on January 30.

From an unsurpassed collection of 17th to 20th century Chinese materials, Dr. Kenneth Starr, Curator of Asiatic Archaeology and Ethnology, has selected the finest for display in the new hall. Through these objects, the visitor will gain a rare glimpse of life as it was in the Peking area under the last Emperors of Old China.

About half of the more than thirty individual exhibit screens within the hall evoke the everyday life of the well-to-do. Here are handsome household furnishings; luxurious clothing, jewelry, and personal accessories; money and other appurtenances of commerce and finance; altar vessels, paintings, and statues representative of religious ceremony and worship; and the games and muscial instruments that enliven leisure.

Folk arts are represented by embroidered bed curtains and children's clothing, cross-stitch "samplers," and intricate paper crafts. These are in contrast to the splendor of imperial court costumes and temple robes. Fine arts include exquisite tapestries, paintings, and figures of ivory, jade, bronze, stone, or cloisonne.

An exhibit tracing the development of the art of calligraphy displays an example older than the first millenium before Christ. The subjects that Chinese scholars thought worthy of study are represented in an assemblage of books produced both by the traditional wood-block technique and by such modern methods as lithography and movable type.

Still another refinement of Chinese intellectual life—the religious and pop-

644—1911

PEWTER ALTAR VESSELS

ular theater—is recreated through grotesquely masked and costumed figures and puppets. A scene from a religious drama depicting the torments of hell dominates the theatrical section of the hall.

Most of the remains of life as it was in Old China—the objects of its material culture—have been destroyed or lost during the past half-century of Chinese history. Collections of the size and quality represented in the Museum's new hall probably can never—even in China—be reassembled again.

These materials represent the end of a historical succession of imperial dynasties that began in the third century before Christ, when all of China was consolidated under one head, and ended forever with the dethronement of the last Manchu emperor in 1911. During the long centuries between, China provided the major cultural focus for all of eastern Asia, including Japan and Korea, the northern and central Asiatic continent, Tibet, and much of Indochina.

It is the period of the last dynasty (the Ch'ing, or Manchu) which has been nostalgically remembered by the sea captains, soldiers, generals, missionaries, traders, and commercial entreprencurs of the 18th, 19th, and early 20th centuries who became known as "old China hands."

Their China—a country of pigtails, fans, and trousered women; of scholarship, quiet courtyards, and elaborate ceremony; of street circuses, bridal processions, and Buddhist festivals—is evoked once again in the objects that visitors will see in the new exhibition.

HAND PUPPETS

COINS

FLAGEOLET

GUITAR

DRAGON KING, LUNG WANG (BRONZE)

PEWTER DISH

(P.R.N.)

CHICAGO NATURAL HISTORY MUSEUM *News*

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N. S. F. Grant Awarded For Meteorite Study

DR. EDWARD J. OLSEN, Curator of Mineralogy, whose scientific work for the past few years has centered on meteorites and the clues they provide to the origin and history of the solar system, will be able to intensify his investigations under a grant of $19,700 awarded by the National Science Foundation to the Museum for Olsen's research.

In this study Olsen will be working with Dr. Robert F. Mueller, Assistant Professor, Department of Geophysical Sciences at the University of Chicago.

The Museum, with more than 1,600 samples, has the largest meteorite collection in the United States. Fragments of nameless planets that have collided in the asteroid belt circling the sun between Mars and Jupiter, meteorites range in size from grains of dust to 60-ton monsters.

With the support of the NSF grant, Olsen and Mueller will analyze the distribution of chemical elements occurring in meteorites between clusters of closely associated minerals. Some of these minerals are found on earth while others are not known from our globe. The distribution patterns of the chemical elements were affected by the maximum temperatures and pressures attained when the meteorite's parent planet was formed. Dr. Olsen holds that, by analyzing the observed distributions and applying suitable theory, it should be possible to reconstruct the temperatures and pressures that originally prevailed. These data should reveal a further glimpse into the history of planets early in the life of our solar system.

Journey Awards

THE Raymond Foundation's Journey program for youngsters, now in its eighth year, can point with pride to a creditable harvest of young Museum "explorers" when it comes time to present awards to boys and girls who have completed certain required numbers of Journeys.

At the fall awards program held last month, 90 youngsters were honored on the stage of the James Simpson Theatre for various levels of achievement in the Journey program. Award certificates are presented for finishing from four to 17 Journeys. With only four Journeys offered each year, young people who have 17 to their credit—which is the highest level of achievement in the program—have been actively engaged in "journeying" for more than four years.

Four young people qualified in that top category this fall and have been welcomed into the Museum's Discoverers' Club. They are: Susan Jane Helfrich, Ralph C. Gushard, Joel S. Kanter, and Keith H. Sutton. As members of the Club they are entitled to a number of Museum privileges, including a free subscription to the BULLETIN.

In other categories of achievement there were: 13 Beaglers (16 Journeys completed); nine Explorers (12 Journeys completed); 27 Adventurers (eight Journeys completed); and 37 Travelers (four Journeys completed).

Those in attendance at the awards program were entertained by John Moyer, in charge of the Museum's Division of Motion Pictures, who presented a film and lecture on the people and wild animals of India.

Nature Photo Exhibit Deadline

DEADLINE for entries to the 19th Chicago International Exhibition of Nature Photography is January 13, 1964. The competitive exhibition, sponsored by Chicago Natural History Museum and the Chicago Nature Camera Club, will be on display at the Museum from February 1 through February 23. Slides chosen as the best of hundreds of expected entries will be projected in the Museum's James Simpson Theatre on two Sundays, February 2 and February 9, at 2:30 P.M.

A panel of five judges is responsible for selecting the photographs and slides featured in the exhibition, and for assigning awards to the most outstanding entries. Included on the panel are two Museum curators: Dr. Edward J. Olsen, Curator of Mineralogy, and Dr. Patricio Ponce de Leon, Assistant Curator of Cryptogamic Botany. The other judges are photographers Mildred A. Glueck, Frank G. Zelenka, and Karl E. Bartel, who is also well known as a naturalist and lecturer.

The exhibition comprises two major divisions, prints and transparencies, with the number of entries per person restricted to no more than four in each division. An entry fee of one dollar, plus return postage, is required for each division, so that if a photographer wishes to submit both prints and slides, he must pay a fee of two dollars.

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Featured

Exhibit

for January

Volcanoes:

Earth's Fiery Activity

By BERTRAM G. WOODLAND

Curator, Igneous and Metamorphic Petrology

Night scene during eruption of Volcan Izalco in El Salvador—Central America's most active volcano.

VOLCANISM, for most of us, conjures up visions of large volcanic cones, eruptions of lava and ash, or the brilliant displays of lava fountains seen against the sky at night. Actually these are only the surface manifestations of the vast turmoil and unrest existing within the earth.

Volcanic outbursts are not only spectacular natural events but sometimes result in great damage and loss of life. Many catastrophes have been recorded: among the earliest is that of the destruction of Pompeii and Herculaneum during the eruption of Vesuvius in August, A.D. 79. Letters written by Pliny the Younger describe this outburst, which caused the death of his uncle, Pliny the Elder. The explosive discharge of large volumes of ash and rock overwhelmed the population. Dust and gases asphyxiated many and the ash buried them in their cellars, so that many centuries later excavations of the site revealed the forms of inhabitants preserved in the volcanic ash. As it had not erupted for many hundreds of years, these people apparently did not realize that Vesuvius was a volcano, although the Romans were fully aware of volcanic eruptions and considered them to be the activities of Vulcan, their god of fire, from whom the name volcano was derived.

Another devastating eruption occurred on the island of Martinique on May 8, 1902. A violent explosion on Mount Pelée drove out a great incandescent cloud of gases and pumice which, traveling at more than 300 miles per hour, en-

(*Continued on next page*)

gulfed the port of St. Pierre, killing 40,000 people. The islands of Indonesia are studded with active volcanoes, which periodically erupt disastrously. In 1883 the volcanic island of Krakatoa exploded, throwing ash many miles into the air. The ensuing collapse of the island into the void below produced a "tidal wave," or tsunami, which drowned over 36,000 people on Java and Sumatra. The dust from the explosion traveled around the world and reduced the sun's radiation at the earth's surface by about one-eighth. Again, as recently as 1963, between February and May, some 2,000 persons lost their lives during eruptions of Mount Agung on the island of Bali.

Occasionally the birth of a new volcano is witnessed; within historic times this has always occurred in well-known volcanic districts. The best-known example of recent years is Parícutin in Mexico. Starting in February 1943, this volcano grew out of a cornfield to form a cinder cone about 500 feet high in the first week and 1,000 feet high in ten weeks. All activity ceased in March 1952.

A 1963 Volcano

Just two months ago, in November of 1963, as a result of a submarine eruption, a new volcanic island appeared off the southern coast of Iceland and rose to a height of 300 feet in six days.

More than 650 volcanoes are known to have been active during recorded history, but the actual number is probably much greater because of the inadequacy of our records. The distribution of the world's volcanoes can be seen on the accompanying map. Many border the Pacific Ocean with offshoots into the Caribbean and Indonesia. Other well-known volcanic regions are the Mediterranean, East Africa, and the islands of the Atlantic and the central Pacific oceans. The volcanic areas of the western United States are now dormant, although Mount Lassen in northern California erupted in 1915 and many of the magnificent volcanoes of the Cascade range were active in the last century. There are many other areas, such as the Craters of the Moon National Park in Idaho, where lava flows are so fresh-looking that one can easily imagine them moving.

Volcanic activity is thus an active constructional agent, which builds up the land's surface and provides us with some of our most spectacular scenery. Some volcanoes are composed of great piles of lava, which flowed to form gently sloping masses called shield volcanoes. Mauna Loa on Hawaii is such an example: it rises more than 30,000 feet above the general floor of the ocean and to nearly 14,000 feet above sea level. Other volcanoes, like Parícutin, are formed largely of cinders —an accumulation of lava fragments blown out of the crater.

Some of the most beautiful mountains in the world are the strato-volcanoes. Composed of countless layers of lava and

PRINCIPAL ACTIVE AND DORMANT VOLCANOES OF THE WORLD

This photograph of Parícutin in eruption is from a series of photographs showing the birth and death of this famous Mexican volcano. The series is part of the Museum's featured exhibit for January on volcanism. The exhibit also illustrates the many different kinds of volcanic action and explains their causes. A diorama reconstructing an active volcanic region sets the stage for displays of actual materials ejected during an eruption, including volcanic bombs, ash, and many varieties of lava.

Located in Hall 34, the exhibit on volcanism was constructed under the direction of the late Dr. Sharat K. Roy, the Museum's former Chief Curator of Geology. For many years Dr. Roy was actively interested in volcanoes, particularly those in Central America. During his field research he made many daring climbs to study the craters of "live" volcanoes.

ash, these forms rise to great heights of conical majesty. Many well-known volcanoes are of this type, such as Vesuvius in Italy, Etna in Sicily, Cotopaxi in Equador, Mount Rainier in Washington, and Mount Fuji in Japan.

When the erupting lava is very viscous, it is hardly able to flow and so frequently builds up into dome-shaped masses, being pushed higher and higher from within. Lassen Peak, in Lassen Volcanic National Park, is an example of such a lava dome. Great out-pourings of lava also take place from long fissures in the earth's crust, from which the molten rock spreads out to form a large sheet. Iceland has experienced such events in historic time; one in 1783 caused great destruction and famine. Central volcanoes commonly form at one or more points along such a fissure. At various times during the earth's history, repeated fissure eruptions have built up thick masses of basalt, one of the main varieties of lava, over vast areas of the world. Such plateau basalts are extensive in India, Brazil, South Africa, and in the North Atlantic region, where they embrace parts of Greenland, Iceland, Scotland, and Ireland. A part of one basalt spread forms the famous Giant's Causeway on the northeastern coast of Ireland. Washington and Oregon also claim one of the world's larger spreads of plateau basalt.

Another type of sheet deposit is to be found in Yellowstone Park. Here, by far the greater part of the volcanic rocks is composed of highly siliceous or rhyolitic material that was thrown out as glowing clouds of gas and ash particles in great explosive fissure eruptions. Because of the heat, the ash was welded together to form a rock, known as ignimbrite, which is very similar to a lava.

Many volcanoes are surmounted by large craters called calderas. Smaller craters may be formed when the tops of volcanoes are destroyed by explosion; larger ones, such as Crater Lake, Oregon, which is six miles across, are formed chiefly by collapse of a part of the whole volcano. It has been estimated that in the case of Crater Lake the volume of the caldera plus the peak that must have surmounted it was about 17 cubic miles, of which less than two cubic miles are accounted for by surrounding debris. The remainder collapsed downward into the chamber occupied by the molten rock, or magma. Space for this debris was provided in part by the volcanic eruptions that preceded the collapse; during these eruptions it is estimated that some six cubic miles of magma were ejected. Additional space for the unaccounted-for volume was evidently made available by the magma draining away elsewhere within the earth.

What Causes Eruptions?

An obvious question about volcanoes is: what causes them? We now have a great deal of information about the nature of the volcanic process, but we are still far from understanding all its aspects, particularly the basic cause. The appearance of large quantities of molten rock, or magma, at the earth's surface led first to the belief that beneath the crust the earth was molten. Later it was thought that there was a continuous liquid shell beneath the crust. Study of earthquake waves and other considerations have led to the rejection of both of these ideas; now the region known as the mantle, which lies between the crust and the earth's core 1,800 miles deep, is regarded as solid.

Toward the center of the earth, the temperature increases at a rate of about one degree centigrade per hundred feet, but below a few miles we have only estimates. However, it is considered that the melting point is never reached in the upper mantle regions because the high pressure raises the temperature of melting. Earthquakes originate some 25 miles below the volcanoes of Hawaii and it is likely that magma is generated at this level. It seems, therefore, that extra heat must be brought up from deeper levels within the earth to bring about partial or, less likely, complete melting

(*Continued on next page*)

of the mantle rocks to form the magma below volcanoes.

Once formed, the magma, because of its buoyancy, will tend to rise towards the surface, particularly if ruptures have formed in the overlying rock. As the magma rises, the pressure on it becomes less and the dissolved gases begin to separate and to form bubbles, much as bubbles are formed when the top is taken off of a soda-pop bottle. This makes the fluid even more buoyant and serves to drive it upward. The magma apparently accumulates in a relatively shallow chamber located a few miles or less beneath the volcano. Continued separation of gas causes the magma to expand because the gas bubbles expand as they move upward. Eventually, sufficient pressures are produced to clear the way for eruption to the surface.

Very fluid magma, with relatively small gas content, usually erupts quietly, pouring out quantities of lava but little ash. The Hawaiian volcanoes erupt in this fashion. Spurts of gas-charged lava are thrown periodically from the lava pits in the craters thus giving rise to the picturesque lava fountains. The solidified lava flow has two characteristic appearances: in one, called pahoehoe in Hawaii, it is smooth and commonly rope-like, containing many small elliptical vesicles formed by gas bubbles. The liquid lava in this case was hot, mobile, and contained relatively little gas, which escaped quietly. The other kind of lava flow, known as aa, is rough, blocky, and contains many large vesicles. It solidified from a cooler but more gas-rich lava, and the escape of the gases caused the fragmentation and break-up of the consolidating material.

With increasing viscosity and greater gas content, volcanic eruptions become more explosive and spasmodic. Gas-fragmented lava is discharged from the craters, producing much ash and cinders and volcanic bombs (clots of lava shaped during fall). Lava flows may also break out on the flanks of the volcano or at its base. Such an eruptive pattern is called Strombolian after the volcano of that name. Vulcanian and Vesuvian eruptions are increasingly explosive and in the strongest outburst there is a violent release of tremendous quantities of gas, which rush upward for thousands of feet and spread out like a mushroom cloud. This is the Plinian type. The ultimate in explosive discharge is the Peléan type, named after the 1902 eruption of Mount Pelée described above. The magma in this case is very viscous, and as the gas separates and expands a tremendous pressure is built up beneath the volcano until a weakened zone finally gives way, often on the flank. The resulting sudden release causes enormous expansion of the gas, and the magma froths up and blows out with great force as a dense incandescent cloud of gas, crystals, and tiny soft glass fragments.

Other Volcanic Phenomena

Volcanoes often show a cyclical activity. Outbursts that become stronger and more frequent culminate in a paroxysmal explosion followed by dwindling eruptions or quiescence. During dormancy or the final decline of a volcanic area, discharges of gas may be the only signs of activity. Hot springs and geysers (a term derived from an Icelandic name) also indicate the dying stages of volcanism.

The world-famous geysers of Yellowstone National Park owe their occurrence to a large cooling mass of igneous rock which lies within the crust below this once very active volcanic area. Most of the steam and hot water is derived from circulating ground water which is heated by the hot gases (mainly water vapor) given off from below. The spasmodic behavior of a geyser arises from the heating, by superheated steam, of water contained in an underground chamber. The weight of the water column elevates the boiling point so that the deeper water becomes extremely hot. Eventually it boils and pushes up the overlying water, some of which, in consequence of the reduced pressure, immediately turns to steam. This great expansion forces the steam to the surface together with the remaining hot water, which is thrown high into the air until the supply of water is exhausted. A new cycle begins with the filling, again, of the underground chamber with ground water.

Sources of underground steam are being utilized for energy production in Larderello, Italy, and Wairakei, New Zealand, by boring into the ground. In the future such geothermal energy will also be obtained in California and Kamchatka.

Although there are many active volcanoes in the world, there are many more extinct ones which have not erupted in historic times. A famous extinct volcanic area is in the Auvergne region of central France. It was here that the volcanic origin of certain kinds of rocks and structures was first demonstrated in the second half of the 18th century. This led to the rejection of the idea that basalt was a rock formed by precipitation in the oceans.

Many other areas, now so eroded that the deep structures underlying volcanoes are exposed, give witness to the constancy of volcanism somewhere in the world throughout geological time. The study of these regions has not only helped to elucidate the structures of volcanoes, but also has revealed how the magma finds its way to the surface, the nature of the variations of the lavas produced, and their relationships to other internal processes of the earth such as mountain-building.

Large populations have settled near both active and dormant volcanoes, one of the reasons being that the breakdown of volcanic lava and ash produces an exceedingly fertile soil which supports intensive agriculture. Active centers for the study of volcanism are maintained in Japan, Hawaii, Italy, and Kamchatka, with lesser ones elsewhere. More are needed to keep the active volcanoes under observation, particularly in Indonesia and Latin America. Eruptions that might cause loss of life can now be predicted by several methods, including the recording of earthquakes on seismographs, observing the tilt of the ground as the magma swells in the chamber below a volcano, and observing the temperature and types of gas emitted. Although the eruptions cannot be prevented lives can be saved, and in some favorable cases it may even be possible to divert lava streams to less destructive paths if advance warning is available. Thus as our knowledge of volcanoes increases, men become more able to live with and survive the depredations of volcanism, earth's fiery activity.

CHICAGO NATURAL HISTORY MUSEUM

Bulletin

Vol. 35 No. 2
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Drawings by Tibor Perenyi

The Ancient Fish Traps OF MECCA

RAINER ZANGERL
CHIEF CURATOR, GEOLOGY

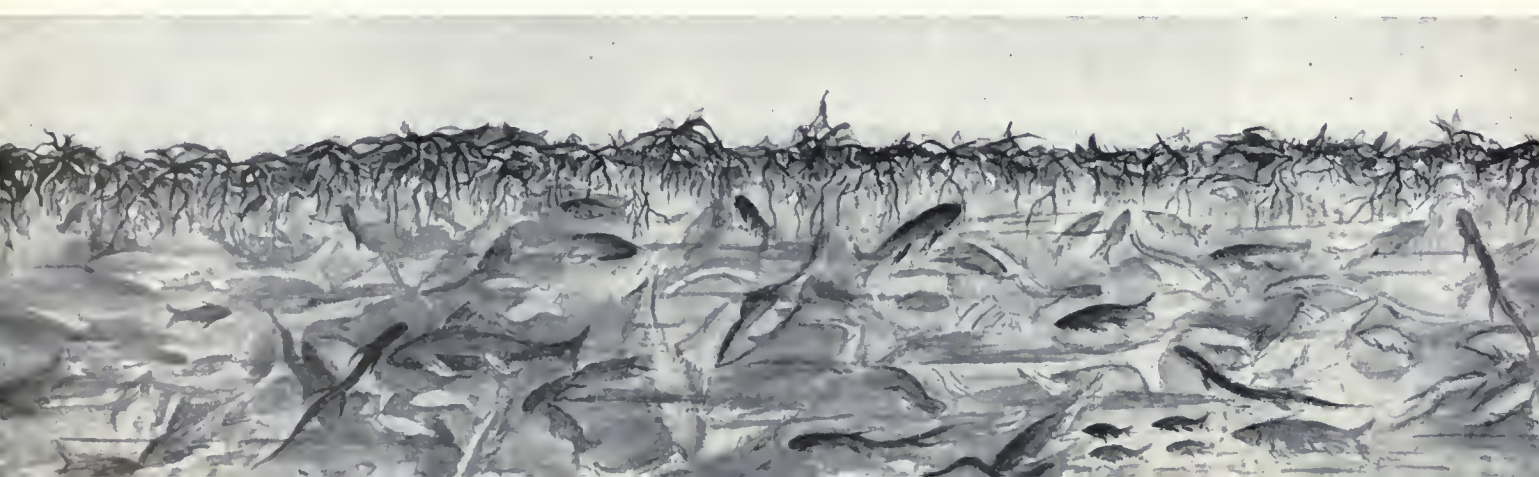
The time was the Pennsylvanian period, approximately 285 million years ago[1], the place the flat heartland of the present United States, that is now the broad valley of the Mississippi River. Thus roughly located in time and space, we may focus more sharply on a fascinating drama with a geographic and time dimension on the scale of our human experience.

First we must paint a verbal picture of the landscape as it would have appeared to an observer on the scene—for example, an insect perched on the frond of a tree fern—near what is now the town of Mecca in west-central Indiana, say in the year 285,000,000 B.C.

What our insect-observer saw was a vast expanse of swampy forest with a thick spongy pad of peat as a floor. The forested land extended for hundreds of miles along the frayed fringes of a warm, shallow, inland extension of the sea, confined in a basin that almost covered the area now called Illinois. Here and there shallow inlet channels drained the swampy coastal plain. The climate was subtropical, rainy seasons alternating with dry ones in yearly cycles.[2]

On the whole it was an extremely serene landscape, and the times had been prosperous, devoid of major disasters. Along the shore of the peaceful sea, marine communities of bottom-dwellers, brachiopods, sea lilies, corals, mussels, and trilobites conducted business-as-usual, and in the swamp a great variety of trees—giant horsetails, scale trees, tree ferns—shot up from the peat floor in rapid succession. But the animal life of the forest itself (probably including many insects and some amphibians) is known only to our observer.

On a fatal day near the end of the rainy season of the year 285,000,000 B.C. all this serenity came to an end. Disaster struck both the busy shore life of the sea and the lush tree community of the coastal belt. Our insect-observer could not figure out what caused the upheaval, but he thought he felt a slight earth tremor shaking his perch just before great waves rolled in from the sea, churning up the bottom on



which brachiopods had built graceful shell-bank structures. The onrushing waters of the sea inundated the peat swamp, dumping shell debris all over its floor. Worse yet, the salt water killed the trees; being pithy structures, for the most part, they were ill prepared to withstand the waves and soon fell over onto the surface of the peat, where they rotted. Gradually, the marine floodwaters receded and peace returned as the dry season of the year 285,000,000 B.C. began.

The country had taken on an entirely changed look. The forest had vanished and the lowland on which it had stood was permanently covered with water. Not a single stick of timber remained standing. But the inundated area teemed with life as our insect-observer might have noted while cruising over the Mecca region: most abundant were small, delicately-shelled scallops that could be seen in large numbers just about everywhere. Common also were cephalopods, distant relatives of the living *Nautilus*. And there were palaeoniscoid fishes, all manner of sharks, and acanthodians resembling eels, but belonging to that ancient group of vertebrates that were the first to evolve movable jaws. As the dry season progressed, the water level gradually sank on the former coastal plain, and the animals that had ventured into this area could no longer be observed from the air because of a thick, floating, mat-like growth of plants (perhaps algal in character—though our observer won't say) that developed at or under the water surface.

What happened toward the end of the dry season and during the following three years is written, so to speak, on successive pages of the packet of evenly bedded, black shale that has been the subject of our intensive study.

The floating mat of vegetation produced a lush growth near the surface, where it had access to light, but the plants beneath died and decayed, their remains forming a dense, very black layer of mud on the bottom. By the end of the dry season the water level had become so low that the floating mat (called a "flotant") actually touched bottom, except here and there where shallow depressions had existed on the former forest floor. Even in such places the water was shoal, possibly one or two feet deep. The slow lowering of the water level resulted in the progressive crowding together of the animals that had ventured out into this newly created fringe zone of the sea. Finally, they were almost wholly concentrated in the residual pools, where most of them perished, and their remains became entombed in the black bottom mud.

The next rainy season marked the beginning of the year 284,999,999 B.C. With the forest gone, water from the higher lands east of the Mecca area was carried in by rivers, flooding much of the former coastal plain. Indeed, the volume of incoming fresh water exceeded the amount that could run off into the inland sea at any given moment. The result was a temporary stagnation all along the new fringe of the basin, so that the water cover may have been several feet deep. Most likely this water soon became somewhat brackish and, with its flow reduced, it shed a great deal of its burden of silt. The flotant, however, seems not to have been materially disrupted.

With the water level high, a new wave of marine creatures pioneered into the Mecca region. They were mostly vertebrates of the same kinds that had come the previous year, but now there were greater numbers. The delicate scallops, however, were not among them.[3] This would tend to indicate that the scallop, of all the members of the buried community of the Mecca Quarry shale, was the only animal that could not tolerate the flooding fresh water. The cephalopods, generally thought to have been strictly marine, are present, however, suggesting that these forms had a notable tolerance to fluctuations in the salt content of the water.

The dry season of 284,999,999 B.C. again saw the gradual lowering of the water level over the Mecca area, and again the animals that had ventured onto the flooded plain became concentrated in scattered residual ponds. The invaders were mostly palaeoniscoid fishes, numerous species of sharks, and acanthodians. A tremendous number of these fishes perished at this time, and their remains were buried in the black muck that accumulated at a rapid rate on the bottom and which is now the dense, black, sheety shale.

Under conditions of severe crowding (the ratio of volume of fish to the volume of water at their disposal lay somewhere between 1:5 and 1:291) one would expect mass mortality to occur from lack of sufficient oxygen in the water, or through poisoning by the noxious gases that developed from the decaying carcasses at the bottom, or perhaps from the overheating of the water in the shallow pools. But, apparently, the death of these animals was not due to causes of this sort; instead, every specimen collected from this deposit shows unmistakable evidence of bite injury, or the fossils represent specimens actually eaten by medium to large-sized sharks that evidently were prone to disgorge hard-to-digest skeletal parts and scales. These "shark pellets" (similar to owl pellets) are among the most common and characteristic fossils of the black shales. Further evidence of feeding activity lies in the occurrence of countless coprolites (fossil dung). The large number of sharks and fishes, prey and predators alike, that were not eaten but merely fatally mutilated, probably reflects a frantic behavior arising from the highly overcrowded conditions in the residual ponds.

During the rainy and dry seasons of the years 284,999,998 and 284,999,997 B.C. the described drama occurred twice more, but by the beginnings of the rainy season of 284,999,-996 B.C., the coastal plain had settled to the point where the following dry season no longer left its mark in the sediments of the area. Now all the coastal plain was under sufficiently deep marine water so that residual ponds no longer formed. No concentrations of carcasses have been found on the burial ground of this year, indicating that the animals had much greater freedom of movement. As the subsidence of the Mecca plain continued and the water became deeper, the flotant disappeared and marine invertebrates established themselves as a new bottom community all over the area.

(*Continued on page 8*)

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NEWS

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THE BULLETIN

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Members are requested to inform the Museum promptly of changes of address.

Conservation Laboratory Established

Mrs. Danziger treats a specimen of primitive art.

THE FIRST laboratory in the Midwest devoted to the conservation of archaeological and ethnological collections is being established in the Museum under a grant of $33,000 from the Robert R. McCormick Charitable Trust.

In charge of the new laboratory is Mrs. Christine Danziger, whose appointment as the Museum's first conservator of anthropological collections was announced in the BULLETIN last May.

The collections in the Museum's Department of Anthropology contain more than half a million specimens from all parts of the world, representing all eras of human history. These collections provide the raw materials of research not only for the Museum's own anthropologists, but also for local graduate students and scholars who visit the Museum from every country of the globe.

Among the most ancient archaeological specimens are the crude tools used more than 400,000 years ago by Peking Man; weapons and carvings made by the prehistoric cave men of Europe; Egyptian fabrics, papyrus documents, glass jewelry, bronze statues, and alabaster urns dating from the 18th to the first centuries before Christ; harness pieces and stucco ornaments from the ancient near East; Chinese bronzes from the Han Dynasty (206 B.C.–A.D. 220); Etruscan sarcophaguses of stone; Roman frescoes and bronzes from Pompeii; and pre-Columbian fabrics and stone sculptures from Central and South America. More recent ethnological specimens include rare works of primitive art fashioned from wood, stone, metal, bone, feathers, and other perishable substances.

All these materials are particularly vulnerable to deterioration. Most of the specimens that would be damaged or destroyed if the natural processes of aging and weathering cannot be halted are irreplaceable today.

Equipment to be installed in the conservation laboratory will make possible the chemical analysis of substances, the diagnosis of any disintegration processes that may have begun, the removal of the products of corrosion and of the corrosion-producing agents, and the stabilization and preservation of the anthropological specimens.

It is anticipated that the techniques developed and used in the new laboratory will be of aid to other museums and universities in the Midwest in meeting problems of specimen conservation.

Aiding in the purchase of equipment for the laboratory is a grant of $4,000 from the Wenner-Gren Foundation for Anthropological Research.

MARCH CHILDREN'S PROGRAMS

FILMS and demonstrations that will stimulate children to enjoy the outdoors more fully this spring and summer will be offered by the Museum on two Saturday mornings during March. "Nature's Wonderland" is the theme of the films to be presented on March 7, which is Camp Fire Girl Day in the Museum. On March 14, Girl Scout Day, the program is on camping. Demonstrations will be given depicting the kind of camping done by the Girl Scouts of Chicago. Programs begin at 10:30 A.M. in the James Simpson Theatre and are free to all children.

(*Museum News continued on page 8*)

Spring Programs for Adults

ON PEOPLE AND PLACES AROUND THE WORLD

An opportunity to see the world through the experienced eyes of well-known adventurer-photographers is provided once again this spring when the Museum presents its 121st season of free illustrated lectures on people and places around the globe. Programs are given on Saturday afternoons during March and April at 2:30 P.M. in the James Simpson Theatre. Reserved seats for Members will be held until 2:25 P.M.

March 7—American Indian Dances

A "live" performance by
The Laubins

A dramatic staging of authentic Indian dances, performed "in person" by Reginald and Gladys Laubin, provides an unusual change of pace for the opening of the Museum's spring lecture series. The Laubins have spent much of their lives with Indians, and "it is no wonder," *The New York Times* reports, "that the Indians themselves are warm in their praise, for certainly no one of their own people has come before the white man with so eloquent and winning a presentation . . . the costumes are gorgeous, making Scheherazade seem downright drab."

March 14—The New World Rediscovered

Laurel Reynolds

In retracing the steps of some of the great explorers of the New World—Columbus, Ponce de Leon, Cabrillo, and Cortez—Laurel Reynolds has rediscovered some wilderness regions remarkably unchanged from the way they must have looked to 15th and 16th century adventurers. Off remote shores whales continue to leap and dive and wood ibis battle for survival in their last remaining grove of virgin cypress. Mrs. Reynolds arrives by yacht—instead of sailing vessel—in the landing places that opened up the New World, and with her motion picture camera succeeds in re-capturing history.

March 21—Bali, Java, and Sumatra

Phil Walker

Indonesia's exotic islands provide a brilliant succession of new experiences for the Western visitor, from exploring a "live" volcano to being caught in a bicycle traffic jam. Among the scenes Walker has recorded are a visit to a Sultan's palace, monkeys climbing cocoanut palms to pluck nuts for their masters, a strange "trance" dance performed by Javanese soldiers, a talk with President Sukarno, a fish fry on Paradise Island, and the festivals of music and dancing for which Bali is renowned.

March 28—The Last Cannibals: Expedition to New Guinea

Jens Bjerre

The dark cults and rituals of primitive life are made vivid and comprehensible in this film of an area that is to this day largely unexplored by civilized man. Bjerre took his expeditionary party into territory that appears only as blank spaces on maps of the island, in order to observe and record the mode of life of warlike cannibal tribes living a Stone Age existence in the 20th century.

April 4—The Holy Lands

Charles Forbes Taylor

In the wake of aroused current interest in the Holy Land, this non-sectarian film-documentary focuses on the places where Jesus lived and taught, as well as those that form the background of Biblical history: Damascus, the route of Moses as he led the children of Israel up the River Jordan through the desert of the Hashemite Kingdom, Bethlehem, Herod's Castle, the Sea of Galilee, Jacob's Well, Jerusalem, Pilate's palace, and Calvary.

From the March 21st film-lecture on "Bali, Java, and Sumatra."

April 11—Valley of the Rhine

Clifford J. Kamen

Only 820 miles long, the Rhine nonetheless is a river of amazing variation as it rushes its way through Alpine gorges to the sea. Flowing through the European countryside, the Rhine passes the tiny principality of Liechtenstein, cas-

(*Continued on page 8*)

JOHN CLARK

ASSOCIATE CURATOR, SEDIMENTARY PETROLOGY

WEATHERMEN to the past

"HEY, DOC, I found a crocodile!"

"Fine! Where'd you find him?"

"Right up there." Kenny's sweat-streaked face, grinning excitedly, poked over the top of a barren rock ledge. "In that pond near the top of the hill." He pointed to a thin, greenish layer in the brown clays of a badlands ridge crossing the hot Utah desert around us. The gritty surface clay crunched to dust beneath our boots as we scrambled hastily up to the site.

Kenny had indeed discovered a crocodile—bones of a baby croc scarcely three feet long. And it had certainly died in a pond. However, the crocodile's life had ended and the shallow jungle pond had filled forty million years ago. Now we saw it as a scattering of small, dark brown objects in a greenish sandstone. We knew that only in the airless waters of a jungle pond would rotting vegetation produce enough carbon to rob the sand's iron minerals of their oxygen and turn them green. Had there been only land, or a cleaner pond, the residual colors would be rust-brown or ocherous. To my enthusiastic young assistant, the dry, dusty present had disappeared, and he *saw* a small, dead crocodile floating among the ferns and leaves of a little pond, shaded by the lush jungle growth that he knew must once have been.

This was as it should be, because formally we were engaged in a study of ancient climates. It was our fascinating job to peer into the past, to the time of forty million years ago, and determine what the weather had been. Was it warm or cool? Were the winters frosty, or did the temperature never drop to freezing? What was the annual rainfall? Did the rains come as a few cloudbursts, or in an annual rainy season, or were they well distributed throughout the year? Which way did the prevailing winds blow? Were they constant, like tropical trade winds; or seasonal, like the monsoons; or variable, like the winds around Chicago?

The first step in determining ancient climates is to reconstruct the geography of the period. We already knew that here in northern Utah an enormous lake had existed for millions of years. A large river had brought water from the mountains of Colorado one hundred miles east and discharged it across flat plains to the muddy eastern shore of that lake.

The ancient mud flats are now shales, and the sand in the channel of the ancient stream is now sandstone that makes winding, sandy ledges across the present dusty flats. Simple measurement of the sandstone ledges showed us that the old channel had been 100 yards wide and six to eight feet deep. This is more than four times as big as the modern White River, which drains the same mountain area today. The coarsest sand in the sandstone was pea-sized gravel; experiments show that water must be moving two to three miles per hour in order to roll pebbles this size along its bed. Four times as much volume of water as the modern White River, moving at least twice as fast, would mean about ten times as much rain as now falls in western Colorado, unless that rain came all during one short season each year, so that more of it would have run off. And that led us to the next question: was the rain seasonal, or well distributed?

The answer to this was revealed by the finely layered shales that had once been the muddy shores of the ancient lake. In these thin layers of shale we found beautiful fossils of tropical leaves and tiny fishes. But between the shaly layers were layers of gypsum and other salts, and the tops of many shale layers were indented by oddly-shaped angular cavities. These were molds of salt crystals that had formed while the shale was still a mud flat and had dissolved away again during the ages since they were buried. Gypsum and salts can only crystallize out of lake waters that are actively evaporating. This meant that the old lake suffered frequent droughts, when the surface evaporated and salts crystallized out on the recently-exposed mud flats. The rainfall was thus seasonal, and the runoff great; we figured that the rainfall in the mountains was probably about five times what it is at present, with alternate seasons of wet and very dry. This would be like the monsoons on the south flank of the Himalayas, in Pakistan.

Which way did the prevailing winds blow? Ash from volcanoes gave us the best clue to that. Volcanic "ash" is actually small, angular grains of volcanic glass; with a microscope, one can recognize it no matter how much sand and mud are mixed in. Naturally, the bulk of the ash from a volcano settles out down-wind, like the tail of a weathervane. The closer one approaches the volcano, the more ash and the larger particles one finds. We found that the amount of ash increased northward, from very little in Utah to considerable amounts in sediments the same age in southwestern Wyoming. The ash must have come from the great Yellowstone Park volcanic centers, and the prevailing winds blew from the north, not from the west as they do today.

Gradually, bit by bit, a picture of the ancient climate emerged from the rocks and fossils of its time. It had been a monsoonal climate. The northerly winds blew during summertime, and brought in rains that dropped probably 50 or 60 inches of moisture on the mountains. Winters were dry, still, and only moderately cool. Probably there was never any frost.

Occasionally the weather around us obtruded itself into studies of the weather of the past. This excerpt from a letter to my wife is typical:

"By Sunday noon we had channeled out five big blocks [of rock containing fossil fish] and right after noon I started to plaster them. Just then, a big cloud passed overhead, and a howling wind tossed our camp bed over 50 feet high in the air. It fell apart, of course, and the heavy canvas dropped, but the bed rolls kept on traveling, with Kenny and me running after, my arms covered with rapidly-setting plaster. Both pillowcases blew off their pillows and we located them a quarter-mile apart. One air mattress landed on a sharp rock and was punctured slightly. The other cartwheeled half a mile before it stopped. After we prospected innumerable gullies for our bedding, we returned and finished plastering. The ground beneath the collapsed air mattress that night was harder than I had supposed."

Desert weather is violent, as the old monsoonal weather probably was not.

Once the ancient weather pattern for that one district was determined, the second and more important step in the research could begin. A coordinated climatic map of North America must be pieced together for this period 40 million years ago, then others for the climates of 35 and 30 million years ago.

Forty million years ago, earth climates were what geologists would consider normal: warm, equable, with the Poles only a few degrees cooler than the Equator. Then the cooling began, which led by stages to the final and highly abnormal Ice Age of the past one million years. Even during the Ice Age, there were four periods when the climate was as warm as or warmer than it is today, so that more than half of the Ice Age was actually not glacial.

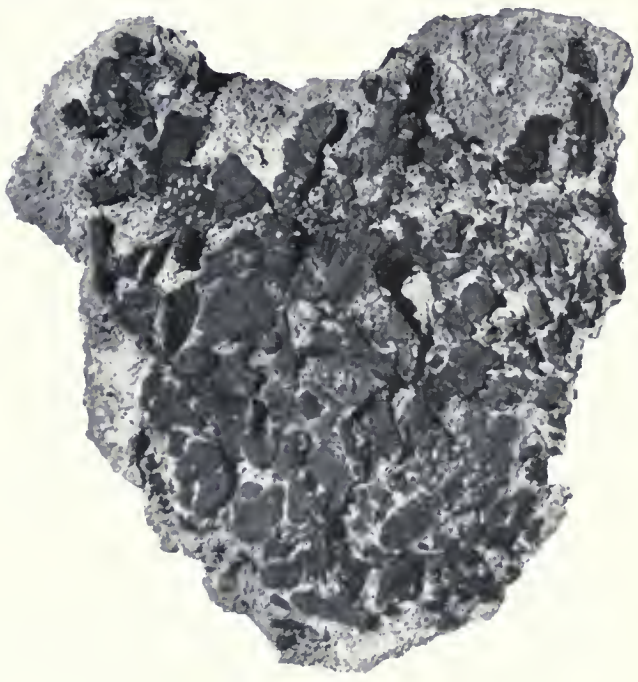
At the present time, the climate at the Poles is warming again. This warming is taking place very fast, even when compared with the span of human life, and it is causing a strong warming trend throughout most of the United States and Europe. This is only part of the story, however. As the temperature rises, the entire wind system alters unpredictably. This changes the rainfall pattern. Areas which now have adequate rainfall may become dry, and dry plains may receive enough moisture to grow crops and develop forests.

If we can learn from the past exactly what the "normal" climatic patterns were during times of general warmth, and how these patterns shifted as cooling progressed, then we can predict how climatic patterns will shift in reverse order as the Poles warm up. It will be like watching a movie film run backwards.

For instance, there is reason to believe that when maximum warmth is reached Illinois will have a climate somewhat like that of northwest Texas today. Only a better knowledge of the ancient climates can tell us how soon this will develop.

In the next BULLETIN an article on "Climates of the Past and Future" will explain what we have learned about the climates of our hemisphere, and outline the grave human problems that will result from the changes we may expect in the future. (END)

Above: Arrows point to line of volcanic ash.



Right: Kenny's fossil "croc."

Ancient Fish Traps
OF MECCA

(*Continued from page 3*)

The muds that preserved them as fossils have become a drab, soft shale with uneven bedding, now overlying the black, sheety shale.

The intensive study of the black, sheety Mecca and Logan Quarry shales at Chicago Natural History Museum has revealed an almost unbelievable wealth of information pertinent to an interpretation and reconstruction of the history and the biological consequences of a marine transgression over a former land area. How was it possible to determine a historic sequence of events of only four years' duration as far back in time as 285 million years ago? This will be the topic of an article in next month's BULLETIN.

[1] Igneous rocks of comparable antiquity have been dated by use of the potassium-argon and rubidium-strontium methods of measuring radioactive decay of potassium–40 to argon–40 on the one hand and rubidium–87 to strontium–87 on the other. For further detail see: Kulp, J. L., "Geologic Time Scale," *Science*, Vol. 133, No. 3459, April 14, 1961, pp. 1105–1114.

[2] The positive tone used in this article must not mislead the reader into believing that this is factual knowledge; rather, it is our interpretation—right or wrong—of a large body of factual data that have been gathered from an intensive study of the Mecca and Logan Quarry shales in Parke County, Indiana. The results of this study have been published by Chicago Natural History Museum. See: Zangerl, Rainer and Richardson, E. S., Jr., "The Paleoecological History of Two Pennsylvanian Black Shales," *Fieldiana: Geology Memoirs*, Vol. 4, 1963.

[3] Our record of the fossil content of the Mecca Quarry sample is very detailed indeed. Yet not a single fragment of a scallop shell was recovered from the shale representing this episode, and only the faint impression of a small part of a shell was collected near the top of the Mecca Quarry shale sequence where it grades into ordinary, drab, marine shale.

Adult Programs

(*Continued from page 5*)

cades below Lake Constance in Europe's most spectacular waterfall, winds through Germany's romantic Black Forest, wends its way through the medieval cities of Freiburg and Cologne, skirts castles and vineyards, and ends its journey through the tiny but progressive country of Holland to the North Sea.

April 18—Italy

Kenneth Richter

Historical and contemporary Italy receive breathtaking treatment in this color film in which the ruins of the Classical Age and the Florence of the Renaissance serve as a magnificent background for a film report on the Italy of today. Included is an intimate sequence on the daily life of an assembly-line worker at the great Fiat plant at Torino; scenes of the great modern painter, De Chirico, at work in his studio; and high-style gowns designed by Fontana of Rome.

April 25—Here's Hawaii

Willis Butler

Although long recognized for its tropical beauty and extraordinary hospitality, America's island state in recent years has attained equal prominence in other important areas. A booming crossroad of the Pacific, Hawaii is a strategic military command post for almost half of the earth's surface. Butler's program starts with the migrations to the isles of the early Hawaiians more than one thousand years ago, and then goes on to portray all facets of life on the four major islands of Hawaii today.

MUSEUM NEWS

(*Continued from page 4*)

FEATURED EXHIBIT

FEATURED Exhibit during the month of February is the Museum's new hall, "China in the Ch'ing Dynasty (1644–1911)," which formally opened on January 30. The exhibition focuses on the everyday life of the upper class Chinese living in the Peking area under the last emperors of China. The hall was installed under the direction of Dr. Kenneth Starr, Curator of Asiatic Archaeology and Ethnology, and was designed by Theodore Halkin, Staff Artist. Assisting in the preparation and installation was Walter C. Reese, Preparator in the Department of Anthropology.

Lectures

Dr. Starr will conduct informal lecture-tours of the hall on Wednesday, February 5, at 10:30 A.M., on Thursday, February 6, at 2:30 P.M., and on Sunday, February 16, at 3:00 P.M. These are open both to Museum Members and the public.

THIS MONTH'S COVER

THE ALERT-LOOKING snail that appears on our cover was photographed by G. Fred Richen of Puyallup, Washington, and captured an honorable mention in the 19th Chicago International Exhibition of Nature Photography. The exhibition, sponsored jointly by the Museum and the Chicago Nature Camera Club, will be on display in the Museum through February 23. The final showing of color transparencies is on Sunday, February 9 at 2:30 P.M. in the James Simpson Theatre.

First place silver medals, for the most outstanding entries in each exhibition category, were awarded to: Ruth A. Cordner, Sierra Madre, California; Grant Haist, Rochester, New York; Robert S. L. Potts, San Francisco, California; Mrs. Trudy Unverhau, Danbury, Connecticut; William Vokoun, Downers Grove, Illinois; T. V. Whitehouse, San Diego, California; Edmund A. Woodle, Natick, Massachusetts.

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CHICAGO NATURAL HISTORY MUSEUM

Bulletin

Vol. 35 No. 3

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Left (Fig. 1): The peculiar armored fish, Bothriolepis, was adapted for life on Devonian stream bottoms.

Cover: Dunkleosteus, giant placoderm of Devonian seas, as he may have appeared in life. The restoration is based on specimens from the Cleveland region. Superimposed on the background painting is a photograph of a cast of the shield displayed in this month's featured exhibit.

Paintings by Maidi W. Leibhardt

ARMORED FISHES OF DEVONIAN SEAS

ROBERT H. DENISON
CURATOR, FOSSIL FISHES

One of the most striking, and at the same time least known, groups of fishes is the placoderms. They are remarkable for their evolutionary radiation into a wide variety of adaptive types, culminating in huge predators of late Devonian seas. Yet they are not widely known because their remains have been identified with certainty only in rocks of the Devonian period, which ended nearly 350 million years ago.

A variety of placoderms is illustrated in the Museum's featured exhibit for March—"Armored Fishes of The Devonian Period"—located at the south end of Hall 38. The exhibit shows actual fossils, as well as models and paintings of the major placoderm groups.

The first known fossil remains of placoderms appear in early Devonian rocks about 400 million years old. These fishes were typically small, heavily armored, bottom dwellers. The heavy armor, a characteristic of the group, is what gives them their name: placoderm means plate-skinned. The armor consisted of a number of bony plates, some of which formed a shield for the head, while others formed a cover for the shoulder or trunk region, the two shields being united by a movable joint in the neck. Rarely are the body and tail preserved, presumably because they lacked any hard parts capable of fossilization. A much enlarged restoration of the armor of one of these early placoderms, *Bryantolepis*, appears in the featured exhibit.

We can say little about the habits of these early placoderms, except that most of them lived and fed on the bottoms of streams and seas. This is shown by the flatness of their lower side, the projecting spines behind the head, the absence of well-developed paired fins, and by the presence of the heavy shield. This shield may have served as an armor, protecting the placoderms from contemporary predaceous fishes and eurypterids.

Some of the descendants of these early forms became more powerful swimmers, as is shown by their streamlined bodies and well-developed paired fins. Flat crushing surfaces on the jaws of some forms show that they fed on hard-shelled food such as molluscs and arthropods. The huge *Dunkleosteus* (shown on this month's cover) developed scissors-like shearing blades on its jaws, which would

(*Continued on page 8*)

THE ANCIENT FISH TRAPS of MECCA

PART II

RAINER ZANGERL
CHIEF CURATOR, GEOLOGY

OUR PLANET Earth has a history spanning about four and a half billion years. The earliest evidence of organisms living on its surface dates back more than 600 million years.[1]

All during these enormous intervals of geologic time, an infinite number of major and minor processes ran their courses. Chemical compounds were formed and destroyed, volcanic ash was transported by winds, gases were vented from marsh bottoms, the remains of plants and animals were buried in sediment—to mention just a very few. Many of these processes required no more than seconds, days, or weeks to be accomplished. Yet all these events, no matter how minute or seemingly insignificant, had some effect upon the environment in which they took place and hence left behind some mark of their occurrence.

The ancient fish traps of Mecca, described in the January BULLETIN, existed during Pennsylvanian time, a period that ended 280 million years ago. Dr. Eugene S. Richardson, Jr., and I have made a detailed study of the fossil fish graveyard found in the Mecca and Logan Quarry shales of Parke County, Indiana. Perhaps the most startling result of this study is that we were able, some 285 million years after the events, to examine and to reconstruct the history of a specific four-year period.

HOW WAS IT possible to date this sequence of events in which vast numbers of animals were destroyed on the fringes of a transgressing (flooding) Pennsylvanian inland sea?

The record is "written" in the rocks, our only source of information concerning ancient geologic events. Potentially, rocks contain a wealth of evidence regarding the conditions that prevailed prior to, during, and since their formation. Experience has taught us, however, that most rocks have undergone such severe changes since the time when they were formed that much of this evidence has been destroyed or so severely altered that we can no longer recognize it.

The present dense, tough, finely laminated shales of the Mecca and Logan quarries look as if their substance had been severely compressed from the time when they were presumably a smelly, semi-liquid mud. Clearly, these are not the kind of rock that one would expect to contain much evidence of the myriad physical, chemical, and biochemical processes that must have occurred on the site where thousands of animal carcasses were buried.

As it turned out, however, just the opposite is the case. These shales are full of fascinating phenomena that are, we believe, related to processes that took place in Pennsylvanian time when the ancient shales were accumulating mud on the coastal plains of the Mecca area.

Most of these phenomena seem to be the result of the disintegration of plant and animal tissues, a process that is always accompanied by the formation of gases (for example, methane and hydrogen sulfide). Under water such gases form bubbles that, being lighter than water, are vented to the surface. If a large bubble forms beneath mud, or within the carcass of an animal, or within a fecal pellet, the escaping bubble disarranges the structures in its path, and such disarrangement, if preserved, may leave a fossil record of that event.

If, on the other hand, the gas bubbles are tiny, they may remain trapped beneath a layer of mud and the gas may chemically react with other compounds in the environment. The result may be the formation of relatively stable substances (for example, pyrite) that become a part of the rock.

Evidence of this sort is very abundant in the Mecca and Logan Quarry shales; it gives testimony to commonplace events of little consequence—or so they would seem, except for the fact that these processes have a small time dimension, measurable in seconds, which provides us with a potential clock built right into the shale.

Suppose it could be demonstrated that the decay process left recognizable marks both in the fossil specimens and the mud in such a way as to indicate the thickness of the mud blanket that had accumulated on a decomposed carcass. This would mean that we could now measure directly the equivalent thickness on the present shale into which the mud has turned.

A SPECIMEN precisely fitting the described situation is shown on page 4. Fig. 1 represents a section cut through a stomach residue pellet of a shark from the Logan Quarry. The pellet contains mostly scales, the leftovers of a meal that consisted of parts of palaeoniscoid and acanthodian fishes. The palaeoniscoid scales appear on the section as elongated black bars, those of the acanthodian as squarish black spots. The scales are embedded in a ground-mass of light brown color.

It may be noted that the palaeoniscoid scales show a peculiar arrangement, and one of them, on the upper side of the mass, extends vertically into the shale; to the left of its tip there is a little "flag"

(*Continued on next page*)

[1] An article by Dr. Edward Olsen, Curator of Mineralogy, explaining the principles involved in absolute dating of the geologic past, will appear in a future issue of the BULLETIN.

(*Continued from preceding page*)

of the brown ground-mass of the pellet, separated from the pellet by a band of shale 2 millimeters thick. Our interpretation of this interesting picture is as follows: the shark regurgitated the stomach residue mass, which settled to the bottom. There it decayed in the presence of air dissolved in the water. Gas bubbles formed and escaped, and the process of decay reduced the volume of the pellet in its upper half, hence the flattened upper side. Then one final bubble formed in the middle of the pellet. As it grew bigger, the palaeoniscoid scales in its vicinity became tangentially aligned to its surface. Then the bubble escaped; as it left the residue mass, it drew a palaeoniscoid scale up into the escape channel, along with a bit of ground-mass. The scale was held in vertical position by the mud that had meantime accumulated on the pellet. The bit of ground-mass settled on the mud surface. Hence, the distance between the little "flag" of ground-mass and the surface of the pellet is the thickness of shale that had accumulated on the pellet during its phase of decay. This distance was 2 millimeters. Similar measurements on other specimens from the Logan Quarry were the same; in specimens from the Mecca Quarry, the comparable measurement was consistently 1 millimeter.[2]

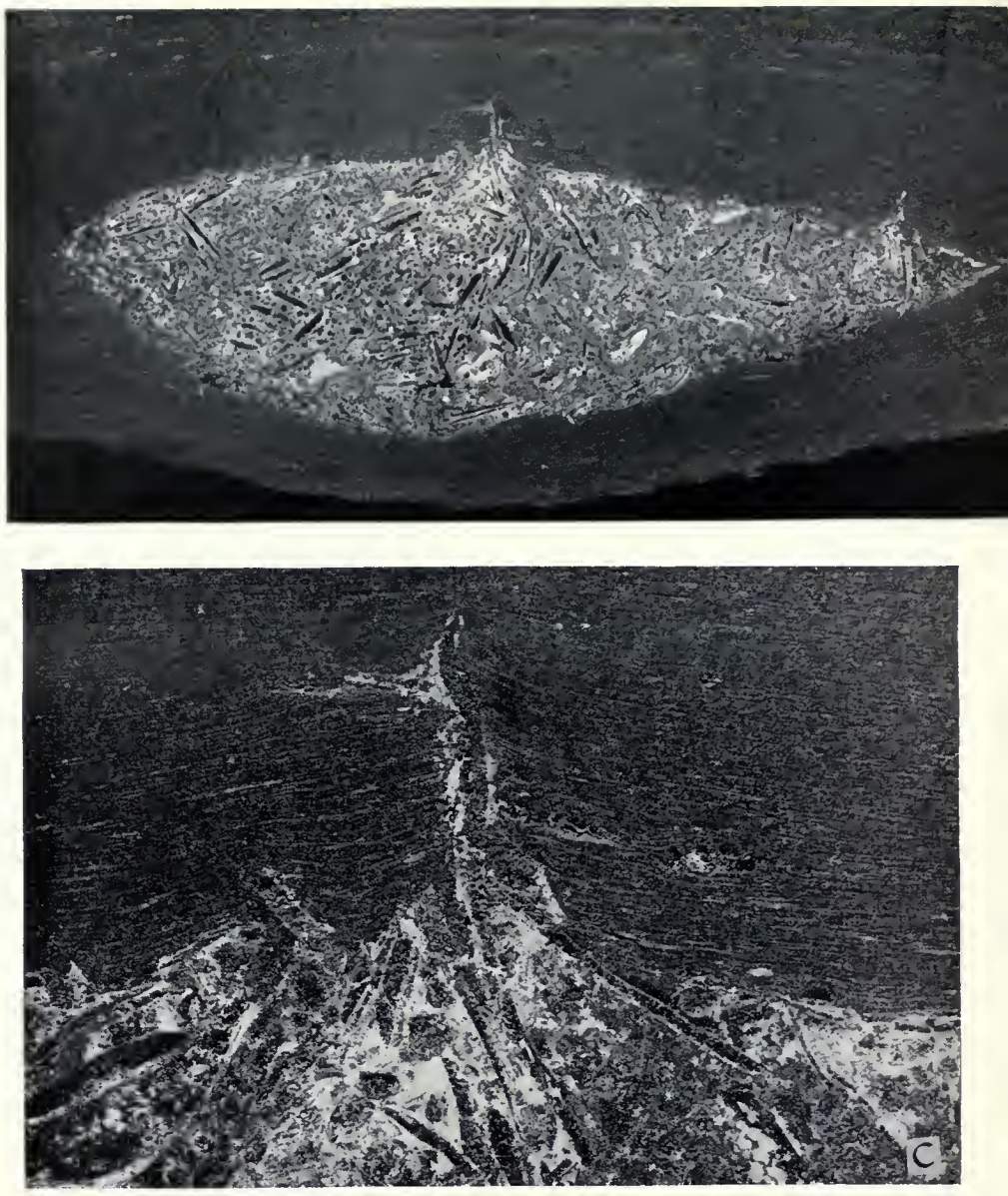

Fig. 1. Two photographs of a section cut through a stomach residue pellet of a shark from the Logan Quarry.

IN ORDER TO learn how long it actually took to deposit this measured thickness of shale—and so "tell the time" by our clock—we now need a reasonable estimate of how long it took a fish to decay to bare bones at the site of the ancient fish traps of Mecca.

We are probably safe in assuming that bacterial decomposition of animal tissues in the presence of air was much the same process in Pennsylvanian time as it is today. The rate of decay today varies greatly with the temperature and there is good reason to believe that this was also true in the geologic past.

The question as to the climate of Pennsylvanian time has been much discussed, especially in connection with the origin of the coal beds that characterize rock sequences of this period all over the world. The evidence is primarily of a paleobotanical nature and is by no means wholly conclusive. But most paleobotanists agree that the Pennsylvanian climate must have been rather warm and devoid of sharp, seasonal temperature differences.

For these reasons we chose the bayou country of Louisiana to determine, by field experiment, the rate of bacterial decay of fishes under conditions that were probably quite similar to those of the ancient Mecca fish traps. At temperatures between 20° and 30° C., fishes weighing three-fourths of a pound decomposed to the bare skeleton in less than one week. It would thus seem reasonable to assume a similar rate of decay for the fishes now enclosed in the Mecca and Logan Quarry shales.

As described above, it was possible to measure the amount of shale (1 millimeter in the case of the Mecca Quarry shale) that had accumulated above a carcass during its process of decay. Since we may assume that the decay process at the ancient burial site near Mecca

(*Continued on page* 8)

[2] The curious aspect of this phenomenon is that the thickness of shale so measured appears also to have been the thickness of mud at the time of deposition. Ordinarily, as mud becomes compacted into shale, one would expect a severe reduction in volume. In this case, however, a great deal of additional evidence suggests that the Mecca and Logan Quarry shales did not undergo compaction in the generally accepted sense, but that compaction took place largely at the time of deposition.

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Members are requested to inform the Museum promptly of changes of address.

For the Children

CHILDREN taking the Museum's new Journey for spring will find themselves in an exhibit land of gay costumes, delightful toys and games, and elaborate puppet theatre. The Journey is to China, or more specifically, to the Museum's new exhibition hall portraying everyday life under the last Chinese emperors.

In traveling the prescribed Journey route, youngsters will discover: how boys and girls of Old China spent their out-of-school hours; the favorite arts and crafts of the Chinese, including some very special kinds of "cut-outs"; the materials with which Chinese students write; and the articles included in the wardrobe of the well-dressed family.

Instructions and questionnaires for the Journey are available at the information desk and at the north and south entrance doors of the Museum.

FOUR Saturday morning film programs for children will be presented this spring by the Museum's Raymond Foundation. They are:

March 7 **Nature's Children**
Camp Fire Girl Day

March 14 **Your Camping Through the Years**
Girl Scout Day

April 11 **The Kingdom of the Elephant**

April 18 **Secrets of Life**
(*A Disney color film*)

The free programs begin at 10:30 A.M. in the Museum's James Simpson Theatre.

Camp Fire Girls of the Chicago area will be honored at the March 7 program. On March 14 special recognition will be given to the Girl Scouts of Chicago. The April 11 film program will double as an honors program, with the presentation of Journey achievement awards to youngsters who have completed from four to 17 Museum Journeys.

LONGER Museum hours begin March 1 when the Museum doors will be open seven days a week from 9 A.M. until 5 P.M.

Saturday Programs for Adults

THE MUSEUM'S spring series of free programs for adults, on people and places around the world, gets under way on Saturday, March 7. The programs are presented every Saturday afternoon during March and April, each beginning at 2:30 P.M. in the Simpson Theatre. Reserved seats for Members are held until 2:25 P.M.

Following is the complete schedule:

March 7—American Indian Dances
A "live" performance by The Laubins

March 14—The New World Rediscovered
Laurel Reynolds

March 21—Bali, Java, and Sumatra
Phil Walker

March 28—The Last Cannibals: Expedition to New Guinea
Jens Bjerre

April 4—The Holy Lands
Charles Forbes Taylor

April 11—Valley of the Rhine
Clifford J. Kamen

April 18—Italy
Kenneth Richter

April 25—Here's Hawaii
Willis Butler

(A description of each program is given in the Museum's February BULLETIN.)

CLIMATES OF THE PAST and FUTURE

JOHN CLARK
ASSOCIATE CURATOR
SEDIMENTARY PETROLOGY

Everyone is aware that our climate is changing. Most people are aware that such temperate areas as Illinois are growing notably warmer. We see cardinals and mockingbirds in the Chicago area, whereas forty years ago they never came north of southern Illinois. Opossums have invaded as far north as central New York State.

From the more serious economic viewpoint, it has become clear that the maple-sugar industry of northern Ohio is dying out because the sugar-maple trees cannot endure the warmer climate. New Englanders who previously fished on the Grand Banks must now ply the less favorable waters off Greenland for their codfish. Siberia and Canada become more prosperous every decade, as the warming climate permits barley and wheat to grow farther and farther north.

How much warmer will our hemisphere become, and what will be the consequences? Even more important, how rapidly will these changes take place?

A glance at the history of climates may help us to predict the future.

The first of the four charts on page 7 shows that we are living in a very abnormal time, geologically speaking. We are either just emerging from a period of glaciation, or are in an interglacial phase of that period. Glaciations have occurred not more than four or five times in the last billion years (the earliest one is problematical both as to time and as to its actual existence), and have been spaced about 200 to 250 million years apart. Most of earth history has seen warm, equable climates, with the poles only a few degrees cooler than the equator.

Looking more closely at the last 100 million years, as shown in Chart 2, we see that there has been a cool time about every 20 million years, with warmer periods between. (Each chart is a blow-up of the right end of the preceding one, giving the added detail we are able to determine as we approach recent time.) A more important trend shows up on this second graph, however. About 35 million years ago, a cooling began that continued far longer than before. The warm time of 20 million years ago served merely to interrupt this general cooling trend. Progressively colder temperatures led finally to the Pleistocene Ice Age.

Even during the Ice Age, as shown in Chart 3, the climate did not remain continuously cold. Continental glaciers formed four times, with longer interglacial episodes of much warmer weather than we now enjoy.

The fourth graph shows climate during the last 10,000 years, since the waning of the last ice sheet. Warmer and cooler periods of a few hundred years' duration have alternated through this brief span of human history and prehistory. For almost a thousand years, from 4000 to 3000 B.C., the climate was much warmer than it is now. The present warming period began about 1850, following 300 years of cold.

These charted records tell us that climates have fluctuated on rhythms of a few hundred years, several thousand years, 20 million years, and 200–250 million years. The briefer rhythms may have occurred throughout time, but our imperfect understanding of the geologic record prevents our recognizing them. Continental ice sheets were produced, apparently, only when cold episodes of the three larger rhythms coincided. Since we are now in a warming period, and ice sheets have all but disappeared, the question is, which one or more of the rhythms have passed into a warming phase? Unfortunately, we have no way of knowing.

The next question is of more immediate interest. How long will this warming continue, and how fast will it progress? Also, what will be its consequences? We do have some of the answers to these questions.

We know that essentially our atmosphere is a thin, fluid film surrounding the earth. The equator receives more heat than do the poles; this sets up a convection system, somewhat like what happens when a broad, shallow pan of water is set partly over a gas burner. This convection system of warm and cool winds, modified by local factors, determines rainfall, temperature, storms, in fact all aspects of weather and climate.

At present, the equatorial "burner" is much warmer than the polar cold spots, so we have an actively moving system like water boiling in a pan. If the poles were much warmer than at present, this "boiling" would partly break down to a series of weaker, local movements like water simmering in a pot. Some places now arid would receive more rain from local, wet winds, while other regions at present well-watered might become arid.

As shown in Chart 4, our climate is warming. At the latitude of Chicago, the increase is about 1° Fahrenheit every 35 years, but farther north it is almost twice as fast. At this rate, how long will it be until Chicago's climate becomes not only warmer, but actually different, due to the setting up of a new convection system? Will this changed climate be like the warm, wet, jungle-producing climate of Florida, or more like the hot, dry summers and dry, cool winters of west-central Texas? Will the change be permanent, or will we revert to our present climate?

In the Museum section on sedimentary petrology we are seeking the answers to some of these questions by looking at the past. We are trying to determine

the actual weather pattern of the last warm time, 35 million years ago (see Chart 2) and the successive patterns as cooling progressed. If we know these, we can presume that the warming trend will again bring each stage to us successively in reverse.

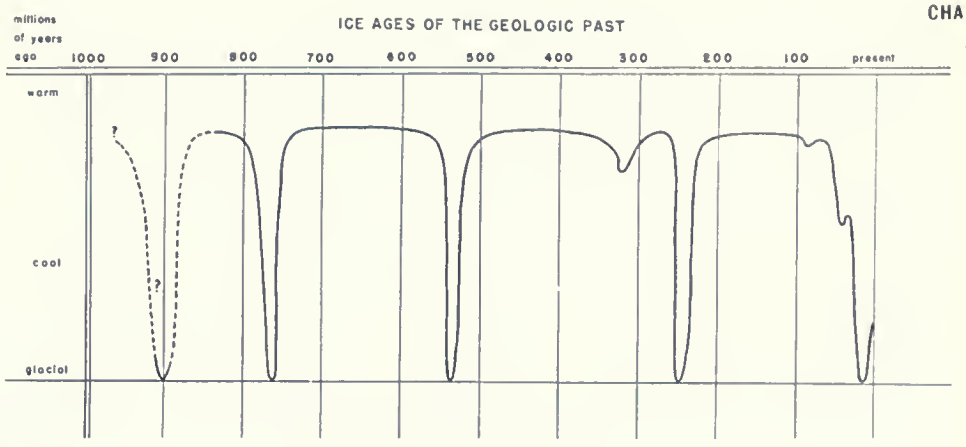
The results of our studies are fascinating, but not yet conclusive. We can expect the present warming to continue for a minimum of 200 years, and probably much more. This should cause—but we are not yet sure—a change in the basic wind circulation of the northern hemisphere. If it does, Chicago *may* become as dry as west-central Texas—but of this we are even less sure. Certainly the present Illinois drought is a local, temporary misfortune unrelated to any long-term trend.

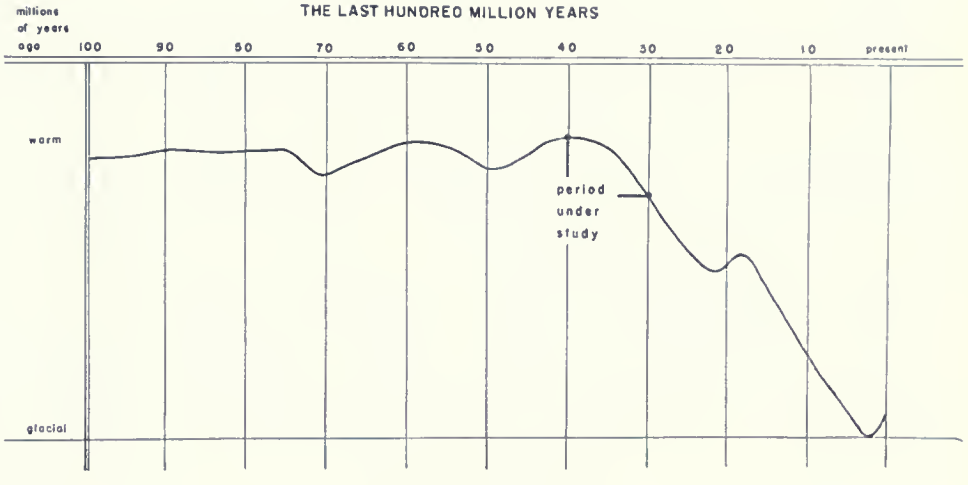
However, the long-term trend *is* causing our generally warmer, drier winters, and is thereby seriously altering our ground-water supply. Farther west, several dams and irrigation projects, built on the assumption that past conditions would continue, are already suffering perennial water shortages which can be expected to increase. There is no need for panic or for crash programs, but definite, practical reasons for pursuing these studies of long-range climatic trends are already with us.

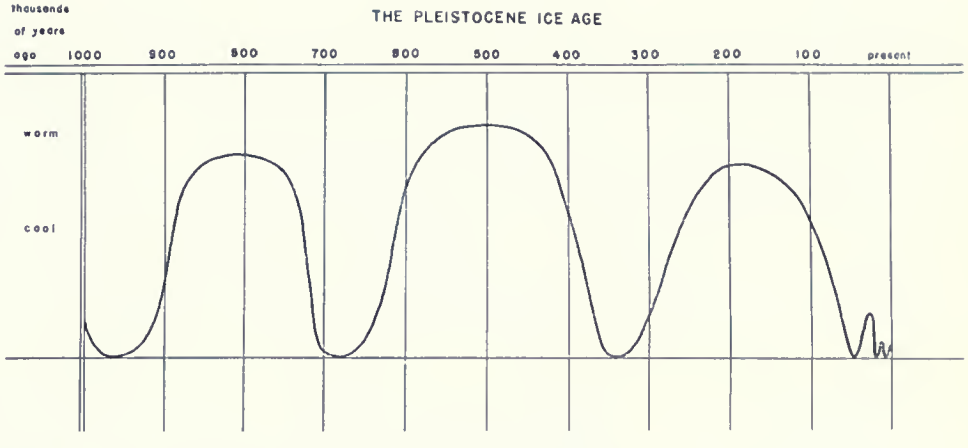
One other important result of the present warming trend will affect the life of everyone on earth. As the polar ice melts, sea level will rise, slowly at first but with increasing speed. This has already started. Sea level is now rising two feet per century; in 1920 the rise was one inch in two centuries. The most conservative estimates anticipate a total rise of over one hundred feet. This would drown out Boston, New York, Philadelphia, Baltimore, and other crowded areas the world over. Altogether, about five hundred million people would be forced to move; where on this crowded earth they would go will be a major problem. How soon will this happen? Certainly not during our generation or our children's, but beyond that we cannot be sure. Probably it will not happen during the next century.

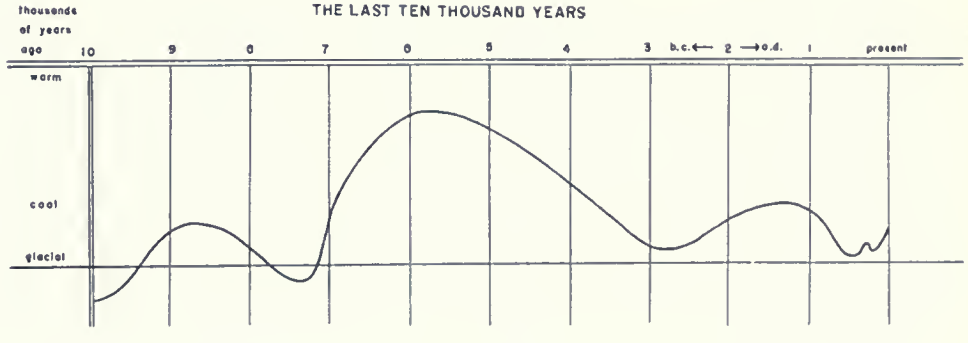
Climate, like everything else in our environment, is dynamic and changing. Our Museum is taking part, along with other research institutions, in studies that may enable us to predict the climates of the future, and to prepare for them. (END)

CHART 1









ARMORED FISHES—

(*Continued from page 2*)

be easily capable of biting other fishes in two. The body and tail of this fish are unknown, but his total length is estimated to be as much as 15 feet. If he was a strong swimmer, and we have no way of knowing surely, he must have been a formidable predator. If, on the other hand, he was a poor swimmer, he may have been a scavenger or a feeder on larger invertebrates. The original of the *Dunkleosteus* in our exhibit is one of many placoderms that have been found in the black shales that underlie the city of Cleveland.

ONE OF THE most peculiar placoderms, and, for that matter, of all fishes, is *Bothriolepis*, the best known genus of a group that was common in middle and late Devonian streams (see Fig. 1). Their distribution was world-wide, and, except for South America, they are known on all continents, including Antarctica and Greenland. Their armor is an exaggerated form of the usual placoderm jointed shield. Instead of proper fins, they had developed a pair of peculiar flippers, usually jointed, with which they propelled themselves around on stream bottoms. The form of the tail is known from impressions that have been preserved in one famous locality on the Gaspé peninsula of Quebec. Their mouth was a small opening bounded by strange jaws on the flat lower surface of the head.

Some years ago, when I was working at Dartmouth College, I had an opportunity to study material collected on the Gaspé by the late Professor William Patten. Serial sections sawed through his specimens of *Bothriolepis* showed a variety of sediments filling the shield. Most of the fill was the same coarse-grained sandstone in which the fossils were buried, yet in the trunk shield of many specimens was a mass of fine mudstone. I soon became convinced that this was a filling of the intestine, and almost certainly was a remnant of some mud that the *Bothriolepis* had eaten shortly before its death. This indicated that this fish fed on mud of the stream bottoms and extracted nourishing material from it in its digestive tract.

A third sediment, this one a fine-grained sandstone, filled certain parts of the *Bothriolepis* that communicated with the exterior. This filling may have happened when a flood killed a number of these fishes by burying them on a stream bottom. The fine sand preserved in part the shape of the mouth cavity and gills. In addition, I could recognize the filling of a pair of elongated, bladder-like or-

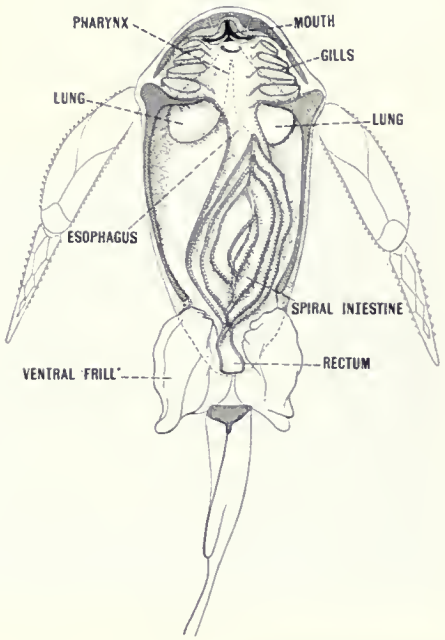


Fig. 2. Drawing by the author.

gans that connected with the pharynx. These sacs could be identified only as lungs, though lungs are air-breathing organs that had previously been thought to occur only in two groups of fishes: lungfishes, and the crossopterygian ancestors of land vertebrates. These sedimentary fillings made it possible for me to reconstruct some of the soft anatomy of *Bothriolepis*, as is shown in the accompanying illustration (Fig. 2).

A third group of placoderms is represented in the featured exhibit by *Gemuendina*, which has a flat body, much enlarged pectoral fins, and a relatively narrow tail. Superficially it looks much like some modern skates and rays, and it must have had similar habits. But in the details of its structure, *Gemuendina* shows its relationship to placoderms, and its similarities to modern skates and rays have resulted from convergent evolution.

PLACODERMS are generally believed to have died out at the end of the Devonian period, which lasted for about 60 million years. It is possible, however, that some members of the group survived until late Paleozoic times and perhaps even until today. Among the fishes found by Dr. Zangerl in Pennsylvanian rocks at the Mecca Quarry (see his articles in this and last month's BULLETIN), are a few that cannot be assigned to any familiar group of fishes; it is not impossible that they will be shown to have a relationship to placoderms. In today's oceans are a number of peculiar fishes with a skeleton of cartilage, known as chimaeroids or ratfishes. Ordinarily they are classified with the sharks and rays, which also have a cartilaginous skeleton. But a number of characteristics suggest that their real relationship may be to a group of placoderms of the Devonian period. Current research may well solve the problems of these questionable relationships and determine whether placoderms, like the lungfishes and crossopterygians, may have survived to modern times. (END)

MECCA—

(*Continued from page 4*)

spanned a similar period of time as it does under like conditions today, we may calculate the rate of deposition of the Mecca Quarry shale as 1 millimeter in about 5 days. For the entire foot of shale at this place (308 millimeters), the period of deposition would thus come to 1,540 days, a value that suggests the order of magnitude of 4 years.

IT REMAINS to be seen to what extent this simple and rather accurate method of determining the passage of time in the distant past is applicable to other rocks than the Mecca and Logan Quarry shales. Henceforth, students of sedimentary rocks are bound to look over their fossils with care for evidence of the kind displayed by the lowly gastric residue pellet from the Logan Quarry. (END)

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Portal design from Viking stave church. Eleventh Century. Urness, Norway.

THE EARLY Scandinavian sea-warriors whose daring raids were feared from Spain to Constantinople, who established kingdoms in England and Russia, who traded with China, colonized Greenland, and explored the coasts of the New World, are the subject of a new exhibit—"Vikings"—opening at the Museum on April 6.

OUR BULLETIN cover reproduces a design carved on the portal of an eleventh century stave church found at Urness, Norway—one of the first Christian churches built by Vikings after their conversion from paganism. A replica of this church front has also been obtained for the exhibit.

VIKINGS — special exhibit April 6 – May 8

Replicas of stirrup and belt ornaments of gold filigree work. Part of famous Viking hoard from Vaernes Kloster in Ostfold, Norway. A.D. 800–1100.

To most of us, the thought of Vikings immediately evokes the bold "dragon" ship, with its carved snake-head prow and ranks of blazoned shields along the bows. In the new exhibit are models of two of the most famous of these ships, excavated at the Oseberg and Gokstad sites in Norway. These replicas, together with the reproduction of a ship prowhead and a map of the Vikings' far-roving voyages, suggest the maritime adventures that made the Viking name a dreaded one among contemporary nations.

The weapons used in Viking raids were the axe, spear, javelin, bow and arrows, and the sword. Among the original pieces obtained for the exhibit are parts of a sword and shield, an iron axe head, and spear- and arrowheads excavated from Viking sites. Because these specimens are Norwegian national treasures, only a very few of them have been released from the collections of the Oslo University Museum of National Antiquities for this exhibition. This will be the first time these original Viking relics have been exhibited in the United States.

At 4 P.M. on the day of the exhibition opening (Monday, April 6), Mr. Helge Ingstad, Norwegian scholar, will lecture on his recent excavation in Newfoundland of what appears to be the first authenticated Viking site discovered in the New World. The lecture will be given in the Museum's James Simpson Theatre and is open to the public.

The new exhibit has been arranged in cooperation with the Oslo University Museum of National Antiquities, the Oslo Marine Museum, and the Bergen University Museum, who have made the original relics and the replicas available. These materials have been brought to Chicago through the courtesy of Scandinavian Airlines System (SAS). In charge of the exhibition is Mr. George I. Quimby, Curator of North American Archaeology and Ethnology. The designer is Mr. Theodore Halkin, Artist in the Department of Anthropology.

"Vikings" will be on display in Hall 9 on the first floor of the Museum through May 8.

1964

MEMBERS' NIGHT

MAY 8

Dr. Edward J. Olsen, in the Department of Geology's Chalmers Laboratory, studies a cross-section slice taken from a meteorite. The Chalmers Laboratory will be one of many laboratories and workshops open to Members on May 8.

MUSEUM MEMBERS once again will have an opportunity to explore areas of the Museum that are "off-limits" to the general public, and to discuss with Museum specialists the latest developments in the natural sciences, when the Museum holds its 13th annual Members' Night on Friday evening, May 8.

On that night the entire staff will be on hand to describe their current work. Through special talks, demonstrations and exhibits, the Museum specialists will be ready to provide answers to a variety of questions, including:

How do geologists determine the existence of fossils in shale and other kinds of rock when the fossil specimens are firmly imbedded in their rock matrix and so deeply concealed that they cannot be detected by the naked eye?

What is the possibility that microscopic plants may someday provide a new source of food?

How does the museum entomologist extract microscopic insects from the forest floor for laboratory study?

What is Central America like today? How do the people live and what is happening to the valuable forest resources of the area?

What are some of the professional secrets used by Museum taxidermists to make exhibit animals look alive?

A DEMONSTRATION in the Department of Geology will show how the fossil content of some rocks can be determined only by a stereoscopic X-Ray technique that enables the scientist to see the details and outline of the fossil without risking the damage that often results when a rock is split. In another geology laboratory Members will see how fossil-bearing rock is stained to reveal fossils that are not clearly distinguishable from the rock that surrounds them.

The food potential of microscopic plants will be described in a display in the Department of Botany. Exhibited under microscopes that visitors may use will be certain common phytoplankton and cellular algae that live in almost every body of fresh water. How these microscopic plants are grown in the laboratory will be explained, as well as how they may be processed in concentrated form for human consumption. Because these microscopic plants are high in protein, vitamins, and minerals, they are today the object of a great deal of research to see if the plants might be the ideal food for future space travel. Other research is aimed at determining whether the tiny plants can be cultivated in such barren areas as the Antarctic and Arctic wastes.

An illustrated lecture on the people and resources of Central America will also be a Department of Botany offering on Members' Night. The lecture will be based on a plant-collecting expedition that recently returned from that area.

In visiting the Division of Insects, many Members have been baffled by a row of large metal funnels impressively set up on a work table in that section. What these funnels represent is a special process that has been developed to extract microscopic insects from materials collected from the forest floor. In the funnels the decaying plants and soil taken from the forest is allowed to dry out, which drives the tiny insects out the bottom of the funnels and into vials filled with preservative. On Members' Night this process will be described in greater detail, and Members will learn why these insects are the subject of current study.

FOLLOWING is a listing, by Departments, of other demonstrations and displays that will be presented in offices and laboratories throughout the building:

Anthropology

ASIAN STUDIES: How the Museum specialist goes about identifying objects of Asian archaeology, art, and folk-art—examples will be drawn from the Museum's extensive Asian anthropological collections (Members are invited to bring with them pieces of their own which they would like to have identified); also, a display of Tibetan art and folk-art objects to be included in a new hall.

(*Continued on page 8*)

CHICAGO NATURAL HISTORY MUSEUM

NEWS

MUSEUM STAFF CHANGES

John R. Millar Becomes Curator Emeritus After 46 Years

After a long and distinguished career of service to the Museum, Mr. John R. Millar has retired as Chief Curator of Botany to become Curator Emeritus.

John Millar came to the Museum for the first time on February 1, 1918, when he was a young man not yet twenty years old. His first position was that of preparator in the Department of Botany, under the supervision of the late Dr. B. E. Dahlgren. At that time the Museum was housed in Jackson Park in the Palace of Fine Arts Building, which had been built for the World's Columbian Exposition of 1893.

Mr. Millar is the only person currently on the Museum's staff who participated in the Museum's move, in 1920, from Jackson Park to its present building in Grant Park—a move that necessitated the construction of special railroad tracks to facilitate the transport of hundreds of thousands of specimens and exhibits. Millar, with the rest of the Museum's staff, was occupied for more than a year in reinstalling these materials in the new home.

Mr. Millar has served the Museum in many capacities. Shortly after he came to the Museum, he spent a number of months at the Plant Introduction Laboratory of the United States Department of Agriculture in Miami, where he collected material and made models for exhibition in the now famous Stanley Field Collection of Plant Models. Further work of a similar kind was performed on subsequent expeditions to British Guiana in 1922, to Brazil in 1926, and to the Bay of Fundy in 1937.

In January of 1937, Millar was appointed Curator of the N. W. Harris Public School Extension. In this position he was able to expand the scope of operation and increase the services performed by the Museum for the grade schools of Chicago.

In 1946 Millar was made Deputy Director of the Museum. He served in this capacity until 1960 when he was appointed Chief Curator of Botany. Now, as Curator Emeritus, he will again be wholly occupied with the exhibition program of the Department.

John R. Millar, with Mrs. Millar, partakes of a cup of coffee at the Museum retirement tea given in his honor. Pouring is Mrs. Dorothy Gibson.

Below: John Millar shakes hands with the new Chief Curator of Botany, Dr. Louis O. Williams.

Louis Williams Appointed Botany Chief Curator

New chief Curator of the Department of Botany is Dr. Louis O. Williams, who has been Curator of Central American Botany.

Dr. Williams did his undergraduate work at the University of Wyoming and received his doctorate from Washington University. Before coming to the Museum in 1960, he was botanist with the New Crops Research Branch of the U.S. Department of Agriculture; subdirector of the Escuela Agrícola Panamericana in Honduras; and research associate at the Ames Orchid Herbarium of Harvard University.

The new Chief Curator's primary research interest is in the flora of the American tropics. He has lived in Latin America for fifteen years and explored most of its tropical regions. Results of his work have been published in more than a hundred papers, monographs, and floristic studies on the Central American region. Currently, two of his research projects are being assisted by grants from the National Science Foundation.

Scientific Editor, Lillian A. Ross, Retires

THIRTY-FOUR years ago, on November 1, 1929, Miss Lillian A. Ross was appointed Chicago Natural History Museum's first Editor of Scientific Publications. Miss Ross had come to the Museum from the University of Chicago and Columbia University, and was equipped with a strong background in Latin, German, and French for the specialized editing required by the new position.

In December of last year, after 750 scientific publications had been printed under her editorial supervision, Miss Ross announced her retirement. This decision, however, has not removed her from the Museum scene. She still comes to the Museum everyday as usual, but instead of reaching for her editor's blue pencil, she reaches for a microscope.

What Miss Ross scrutinizes under the microscope are spiders, for many years her private hobby—an interest that developed as the result of her association with the Museum.

It all began a number of years ago, Miss Ross told us, when she was planning a vacation trip to the Virgin Islands. One of the Museum entomologists, hearing of her contemplated trip, asked Miss Ross to do him the favor of collecting some insects the Museum needed from that area. In hunting the desired specimens, Miss Ross became aware of the beauty of certain spiders' webs, "golden threads artistically and ingeniously woven into intricate nets that spread overhead like canopies in the lush jungle vegetation." As a result, on that trip she collected spiders, as well as the insects requested.

"Now, every place I go I take bottles for gathering specimens," Miss Ross admits.

So far, her spider expeditions have taken her to numerous islands in the Caribbean, including Cuba, Jamaica, the Cayman Isles, and Puerto Rico. In addition to preserving specimens in alcohol for microscopic study, Miss Ross has also taken some spiders alive for pets. The most famous of her pets, kept for years in a glass box on her office desk, was a tarantula.

Many Members may recall Miss Ross' tarantula from Members' Nights in the past, when for years it was a non-official attraction that drew a steady flow of visitors to the editor's office. Visiting Members would press fearlessly around Miss Ross' desk for a glimpse of the creature, but, Miss Ross relates jocularly, when she thought it was time for the next group to have a look, all she had to do was make a movement toward the lid of its glass box, "and the crowd would scatter miraculously."

Currently, Miss Ross is most interested in the genus *Ceraticelus*, a group of small spiders found locally and in the subtropics.

Miss Ross plans eventually to publish some of her findings—which will give her an opportunity, at last, to sit on the other side of the editor's desk.

Chicago Natural History Museum
Founded by Marshall Field, 1893

Roosevelt Road and Lake Shore Drive
Chicago, Illinois 60605
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Austin L. Rand, Chief Curator of Zoology

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Members are requested to inform the Museum promptly of changes of address.

New Botanist Appointed

DR. GABRIEL EDWIN

IN MARCH, Dr. Gabriel Edwin was appointed Assistant Curator of Vascular Plants in the Department of Botany.

Dr. Edwin did most of his undergraduate work at Washington University and received his Ph. D. from that institution. For the past fifteen years he has been with the U.S. Department of Agriculture, most recently serving as Curator of the Herbarium of the National Arboretum in Washington, D.C.

For a number of years, Dr. Edwin has worked on the American hollies, and recently completed a monograph on this subject which will be published this year. He has also worked on the flora of the western United States and that of tropical America.

At the Museum, his initial research project will be to complete the remaining portions of the Museum's monumental *Flora of Peru*.

also in Botany

Mrs. Dorothy Gibson has been appointed Custodian of the Herbarium in the Department of Botany. For the

(*Continued on page* 8)

James P. Bacon, research assistant, carries on the Borneo Zoological Expedition from a jungle treetop perch. See article.

EXPEDITIONS 1964

DURING 1964, Museum research in the field begins in our own Great Lakes region and moves to the far West, to Europe, Australia, Borneo, and the Indian Ocean. Here is the roster of field trips for each Museum Department.

ANTHROPOLOGY. *Dr. Donald Collier* is planning a six-weeks' study trip to museums in Spain and the U.S.S.R. In Moscow he will deliver a paper at the International Congress of Anthropological and Ethnological Sciences and study the American collections in the Museum of Anthropology. He will also observe Soviet museum exhibition techniques in Moscow and Leningrad. In Madrid he is scheduled to talk at the 35th International Congress of Americanists and in Seville he will study Inca and Aztec materials from the time of the Spanish Conquest.

Dr. Paul S. Martin will again return to the Southwest, where he is investigating the culture of early man in eastern Arizona. Each year, Dr. Martin's archaeological "digs" provide a rare opportunity for the training of students. Other continuing field work in the Department is that of *Mr. George I. Quimby*, who will be exploring the Upper Great Lakes region for Indian sites of the period between 1600 and 1760.

BOTANY. This spring *Dr. Louis O. Williams* returned to the Museum with a harvest of botanical specimens from the western slopes of the Sierra Madres in Guatemala. He collected, also, on the same chain of volcanic mountains in western Costa Rica early this year.

GEOLOGY. *Dr. John Clark* is scheduling a series of summer field studies in Illinois and Indiana to carry out paleoecological explorations that will tie in with the paleoecological work in this area which *Dr. Rainer Zangerl* and *Dr. Eugene S. Richardson, Jr.* have been engaged in for several years. Dr. Richardson expects to concentrate his field work in Will and Kankakee Counties, where he will search for Pennsylvanian fossils in the strip mines. Also working in Illinois is *Mr. Harry E. Changnon*, who is collecting information for a guide to the geology of the Chicago region to be used by teachers and students of this area.

Wyoming is the target of *Dr. Robert Denison's* 1964 field studies. He plans to hunt for the remains of the earliest known vertebrates in Ordovician rocks of that state. *Dr. Bertram G. Woodland* will continue his research on the structures of metamorphic rock in the Central Black Hills. During trips to Montana and Ontario, Canada, *Dr. Edward J. Olsen* will seek terrestrial mineralogies similar to the meteorite mineralogies he has been analyzing this winter in the laboratory.

And in southern Australia, *Mr. William D. Turnbull* is continuing his search for fossil marsupials of the early Tertiary and late Cretaceous periods.

ZOOLOGY. Last month *Dr. Joseph C. Moore* completed a world-wide trip to examine museum specimens of beaked whales. *Mr. Loren P. Woods* is presently on the research ship, *Te Vega*, continuing his studies of the fishes of the Indian Ocean under joint auspices of the United States Program in Biology and UNESCO. This year, the Borneo Zoological Expedition moved to a new site to continue its collecting and observation of lizards, snakes, and frogs. According to *Dr. Robert F. Inger*, current work is being done from tree platforms at various heights from 60 to 110 feet above the ground.

FEATURED EXHIBIT
in
APRIL

One of the displays in the April Featured Exhibit is the young horned owl pair at the left, invaders of a crow's nest. (Owls do not build nests.)

Nests and Eggs

EMMET R. BLAKE
Curator of Birds

CALENDARS have their uses, but for the museum ornithologist the seasons, if not the months themselves, are revealed almost as well by the fluctuating volume and pattern of inquiries about birds that are received in the course of a year.

In late fall and winter, for example, most of the calls are for help in identifying strange birds seen along the lake front or through the kitchen window—the loons, ducks, gulls, sparrows and others that nest in the North and seemingly arrive from nowhere with the first cold weather. Other questions relate to feeding stations and their maintenance. Winter may be judged far spent when, usually in February, some one phones to announce the return of the "first robin," a bird that, more likely than not, never bothered to leave the Chicago area at all.

Spring ushers in the period of greatest activity—both of birds and, to judge from my telephone calls, of those who interest themselves in birds. The correlation, in a sense a symbiotic relationship, is reflected in the mounting demand during March and April for information about the spring migration, and where or when various species can be found. At this time, too, we have learned to expect urgent inquiries about the arrival date and housing requirements of purple martins (April 15).

In spring even the schools appear to respond to the resurgence of activity in the world of birds. At that season we can expect to be inundated with calls from distraught parents who, while professing to need information for a youngster, patently are themselves resigned to finishing a school assignment too long delayed. And it is April with certainty when a worried householder complains that woodpeckers are drilling nesting holes all over his roof and siding. What can be done about it? Fortunately, we can reassure the homeowner, for woodpeckers do not customarily dig nesting holes in houses and the bird's noisy rat-a-tat-tat, usually of brief duration, is but an expression of spring-time exuberance or, perhaps, a means of communication with its fellows.

Appropriate to the season is this month's featured exhibit of nests, eggs, and young birds at the west end of the Boardman Conover Hall (Hall 21, first floor, west). There one can see not only the eggs of most birds that commonly nest in the Chicago area but also striking examples of the variability of birds' eggs in size, shape, color, and markings. Nests from many parts of the world illustrate the remarkable diversity of constructions and of the materials utilized by birds for the protection of their eggs and young. Other exhibits in nearby wall cases illustrate some aspects of reproduction in birds, and the several types of juvenile development.

This Pied-billed Grebe found as a suitable site for her nest a bed of cattails at the Morton Arboretum. (Photo by Emmet R. Blake)

MUSEUM NEWS

(*Continued from page 5*)

past two years, Mrs. Gibson has been Assistant in the Department, having previously served as Secretary.

Oceanic Curator Joins Staff

In the Department of Anthropology, Fred M. Reinman has joined the staff as Assistant Curator of Oceanic Archaeology and Ethnology.

Mr. Reinman has been Lecturer in the Department of Anthropology at the University of California, Los Angeles, and is a doctoral candidate of that University. In line with his research interest in maritime adaptations of primitive island peoples, Mr. Reinman has made a number of archaeological investigations of extinct Indian sites on San Nicolas Island and other offshore islands of California.

Here at the Museum, he will have an opportunity to continue this interest through the resources of the Pacific Research Laboratory, one of the Museum's major research facilities. The Laboratory contains the largest collection in the United States of ethnological materials from the South Sea Islands, and includes the world-famous Fuller collection.

FRED M. REINMAN

Editor Appointed

The Museum's new Editor is Mr. Edward G. Nash. A graduate of Fordham University, Mr. Nash majored in English and Philosophy. His academic preparation includes training in Latin, Greek, and French, as well as a year of study at the University of Louvain in Belgium. He comes to the Museum from an editorial position with *Time* Magazine in New York.

Helen A. MacMinn 1898–1964

Mrs. Helen A. MacMinn, Associate Editor of Museum Miscellaneous Publications for 17 years, died suddenly last month in her home in Hammond, Indiana.

Mrs. MacMinn retired from the editorial staff one year ago, ending an association with the Museum that began in 1945. Since 1947, she had been Associate Editor in charge of the Annual Report, the Raymond Foundation's children's stories, the Museum Guide and numerous other Museum publications in the popular series, as well as exhibit labels, posters, and post cards.

Mrs. MacMinn was born in Chicago in 1898. She attended Indiana University and the University of Chicago, and received a Master's degree in English Literature from the University of Illinois.

Her death has greatly saddened all her friends at the Museum.

MEMBERS' NIGHT (*Continued*)

Botany

VASCULAR PLANTS: Flowering plants that parasitize other flowering plants

BOTANICAL CURIOSITIES: Use of curious plant materials for adornment

HERBARIUM: How botanical specimens are preserved for study through the centuries

PLANT REPRODUCTION: How the Museum's exquisite plant models are made

Geology

INVERTEBRATE PALEONTOLOGY: Coal Age fossils of Illinois

SEDIMENTARY PETROLOGY: Predicting the weather of the future by reconstructing climates of the ancient past

MINERALOGY: An informal tour of the Museum's meteorite collection

Zoology

BIRDS: Birds' eggs from the Museum's collection of some 60,000 specimens

FISHES: Types, sizes, shapes of fish scales

INSECTS: Research underway on the Ectoparasites of Panama; fossil insects (including insects in amber); large and showy insects; preparing specimens

TAXIDERMY: Taxidermy and tanning techniques; exhibits in progress

On May 8 the Museum's doors will open at 6 P.M. The cafeteria will be open until 7 P.M. At that time Members will be admitted to the third and fourth floors and to the ground level Division of Fishes and Reptiles, where they may wander freely through laboratories, workshops, storage rooms, and offices.

Members' Night ends at 10 P.M. Special shuttle buses to carry visitors to and and from the Loop will be available every fifteen minutes from State Street and Jackson Boulevard.

EIGHTY-SEVEN RECEIVE JOURNEY AWARDS

Eighty-seven youngsters will receive awards on the stage of the James Simpson Theatre, Saturday, April 11, at 10:30 A.M., for outstanding achievement in the Museum's Journey awards program.

The awards will be distributed according to five levels of accomplishment: for completion of four, eight, twelve, or sixteen Journeys—with the highest honor, membership in the Museum's Discoverers' Club, going to those "journeyers" who have gone on to successfully finish the special honor Journey, the "Voyage of the Beagle." This spring 12 new members will be admitted into the club, the largest number in the nine-year history of the Journey program.

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CHICAGO NATURAL HISTORY MUSEUM

Bulletin

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CHICAGO NATURAL HISTORY MUSEUM

News

Museum exhibits of every variety—from turtles to South Sea masks—are reflected in an exhibition of student art opening May 18.

Student Art Exhibit

THE CHALK drawing reproduced on this month's cover is from the Museum's annual spring exhibition of art by students in the Junior School of the Art Institute of Chicago.

Created by young artists aged 5 to 18, the more than 50 paintings and drawings on display were stimulated and inspired by Museum exhibits. A variety of techniques, including collage, scratchboard, and various paint media, are employed in the spirited and imaginative exhibition. It can be seen from May 18 through June 9 in Hall 9, on the Museum's first floor.

Science Fair

HUNDREDS of top science projects designed by students of the Chicago area will be on exhibit in Stanley Field Hall on Saturday, May 23, from 9 A.M. until 5 P.M., in the 16th Annual Chicago Area Science Fair.

An outstanding demonstration of student comprehension and application of scientific principles, the Fair brings together projects carried out by sixth graders through high school seniors in the public, private, and parochial schools within a 35-mile radius of Chicago. The exhibits have been chosen for display in the Museum through preliminary competitions held in each school. The Fair is sponsored by the Chicago Area Teachers Science Association.

Library Honored

CHICAGO Natural History Museum Library has been designated a United States Government Depository Library to receive publications under the selective plan of distribution. This means that the Museum Library will now enjoy the privilege of receiving, free of charge, many publications in fields related to the Museum's programs of research which are published by agencies of the Federal Government. Among these agencies are the United States National Museum, the Smithsonian Institution, the Library of Congress, the Department of Agriculture, the Department of the Interior, the National Science Foundation, and the National Research Council.

Staff Notes

THE ASOCIACION Ornitological Del Plata in Buenos Aires has recently honored two Museum ornithologists. Dr. Austin L. Rand, Chief Curator of Zoology has been elected a Corresponding Member of the Association, whose publication is *El Hornero*. Mr. Emmet R. Blake, Curator of Birds, was elected an Honorary Member in recognition of his "valuable contributions to the knowledge of neotropical birds."

Mr. Blake has also been appointed to the Committee on Classification and Nomenclature of the American Ornithologists' Union. This committee will be responsible for preparing the sixth edition of the official *Check-List of North American Birds*, which will be expanded to include Mexico. The volume is scheduled for publication in 1972.

Marion G. Grey
1911 – 1964

THE MUSEUM records with deep regret the death on March 20, 1964, of Mrs. Marion G. Grey (Mrs. Arthur L. Grey), Associate in the Division of Fishes. She was 52 years of age. Mrs. Grey became associated with the Museum as a volunteer with an interest in marine invertebrates. During World War II when the Curator of Fishes was serving in the Navy, Mrs. Grey kept the Division operating and was elected an Associate in 1943.

Her interest in marine biology began

(*Continued on page 8*)

Drawing by Marion Pahl

THE FIRST ship of record to sail on Lake Michigan was La Salle's trading vessel, the *Griffin*. In August of 1679 this vessel sailed from the east end of Lake Erie to St. Ignace on the northwest side of Lake Huron and then across northern Lake Michigan to one of the islands lying at the opening into Green Bay. In September of 1679 the *Griffin* sailed from the Green Bay island and disappeared, never again to be seen by her French owners.

The *Griffin* usually is depicted as a large three-masted ship, the typical man-of-war and freighter of the seventeenth century. On the Franquelin map of 1688, such a ship shown in Lake Michigan and also in Lake Huron is probably meant to represent the *Griffin*. Many museum exhibits and many book illustrations also portray the *Griffin* as a large seventeenth century freighter with three masts and elaborate rigging. I intend to show that La Salle's vessel was a much more modest boat and not at all like the magnificent freighters or men-of-war that usually have been the bases for pictorial reconstructions of the *Griffin*.

Father Louis Hennepin, a Récollet missionary, witnessed the building of the *Griffin* and was a passenger on the vessel during her voyage. He kept a journal and his written statements are the primary historical source of information about the ship and its voyage. However, Hennepin's account is so incomplete that one does not know what kind of vessel the *Griffin* was or where she actually went in Lake Michigan. I propose to remedy this lack by making an historical reconstruction of the ship and her voyage.[1]

(*Continued on next page*)

The Building of the *Griffin*

THE SHIP was built in the late winter and spring of 1679 above Niagara Falls, probably at the mouth of Cayuga Creek. A master carpenter, a blacksmith, and fewer than ten other carpenters and workmen built and launched the *Griffin* in the period between January 22 and May 27, 1679. When one considers that the wood came from trees felled nearby and that all of the ship's timbers and planking had to be cut and shaped *in situ*, then fitted into place and fastened, it does not seem possible that so few men could have built a ship of any great size in a period of approximately four months.

SIZE

ALTHOUGH there are no direct statements concerning the dimensions of the vessel there are statements of her burden or cargo capacity. Hennepin says the *Griffin* "was but 60 Tuns" burden. In earlier editions of his work he said the ship was about 45 tons burden. It is thus a fair conclusion that the *Griffin* was of 45 to 60 tons burden. In the seventeenth and eighteenth centuries, and even now in some cases, such a ton was not a unit of weight but was a unit of space, specifically 40 cubic feet, which can be encompassed in a block four feet long, five feet wide, and two feet deep. If the *Griffin* was of 60 tons burden she had a capacity of 2,400 cubic feet (60 x 40), which is the equivalent of a box 40 feet long, 10 feet wide, and six feet deep. If the *Griffin* was of 45 tons burden she had a capacity of 1,800 cubic feet (45 x 40), which is the equivalent of a box 30 feet long, 10 feet wide, and six feet deep.

The formula for computing tonnage in colonial times, according to Samuel Eliot Morison, was the length of the ship on deck minus three-fifths of the greatest breadth multiplied by the greatest breadth multiplied by the depth of the hold divided by 95. With this formula, the known tonnage of the *Griffin*, and some additional clues, one can approximate the probable dimensions of La-Salle's vessel.

One of the additional clues concerns the draught (depth below water line) of the *Griffin*. On August 24, 1679, the ship was in Lake Huron, according to Hennepin, "becalm'd between some Islands, where we found but two Fathoms Water, which oblig'd us to make an easie sail part of the Night." Thus the *Griffin* could navigate satisfactorily though cautiously in 12 feet of water. To do this the ship would have had to have a draught of much less than 12 feet. Even a draught of six feet would require extreme caution in sailing through unchartered waters of two fathoms.

Another clue involves the proportions of seventeenth century vessels, which were more box-like than nineteenth century sailing ships. For instance, the breadth of seagoing boats in the seventeenth century was at least one-third and probably two-fifths of the length. In 1665 the *Eaglet* of the British South Seas Fleet was 40 feet long and 16 feet wide. This boat was larger than the *Griffin*, if one accepts Hennepin's earlier statement that the latter was about 45 tons burden.

If the *Griffin* was of 45 tons burden the available evidence suggests that she was a small vessel, perhaps 37½ feet long, with a maximum breadth of 15 feet and a depth of 10 feet. These figures fit the colonial formula for a 45-ton vessel. And although the exact dimensions of the *Griffin* are not known at the present time, she certainly must have been not more than 40 feet in length and not more than 16 feet in breadth. She probably had a draught of four or five feet and a freeboard (height above the water line) of five or six feet.

RIGGING

THE ANCHORS, cables, ropes, sails, rigging, and other fittings for the *Griffin* were shipped from Fort Frontenac by sailing vessels to the head of Lake Ontario, then carried on foot to the temporary ship yard above Niagara Falls. Father Hennepin noted that the *Griffin* was completely finished and rigged by July 4, 1679.

Father Hennepin wrote very little about the ship's rigging. He mentions a vessel rigged as a brigantine (his use of the term "bark" referred to a small vessel and not a type of rig) on Lake Ontario and should have said so had the *Griffin* been thus rigged. Hennepin did say that she was "well Rigg'd, and ready fitted out with all the Necessaries for Sailing." With reference to a storm on Lake Huron, Hennepin wrote, ". . .we brought down our Main Yards and Top-Mast, and let the Ship drive to the Mercy of the Wind. . . ." When the storm was over, "we hoisted up our Sail. . . ." With these few simple but positive statements it is possible to make some observations about the rigging of the *Griffin*.

The mention of a "Top-Mast" and "Main Yards" suggests that the *Griffin* was not rigged as a ketch. The ketch of this period was rigged with lateen (triangular) sails and did not need topmasts. Moreover, the ketch rig would have had only one main yard (set diagonally) and Hennepin's use of "Yards" implies that there was more than one yard on the mainmast. Had the *Griffin* been rigged as a ship or a brig there should have been more than one topmast to bring down during a storm such as he describes. Also, in such an instance there should have been only one main yard and a number of other yards to bring down. And finally, ship or brig or brigantine rigging, unless unusually modified, should have been too complicated for a pilot and five men to handle on the return voyage to Niagara.

The only direct evidence from Hennepin's account suggests that the *Griffin* had a mainmast, a main-topmast, and two yards for square sails that were set on this compound mast. In short, the driving sails were on the mainmast and by implication any other sails used must have been very small and set on a mast or masts that could have been removed from the deck by one or two persons and did not require shrouds for their support. Such small sails, if present, were used for balance and ease of steering. The only driving sails were on the mainmast.

That such rigging was known in the seventeenth century is demonstrated by the pictorial embellishments on the Franquelin map of 1689. On that map, in the area of the Gulf of Mexico, are pictured two small sailing vessels 30 to 40 feet long, each with a large mainmast and a small foremast stepped close to the bow and tilted forward. The two large driving sails, both square in out-

line and each with its own yard, are set on the mainmast. A small sail, as much for balance as drive, is set on the short foremast. This style of rigging would correlate perfectly with Father Hennepin's statements about the rigging of the *Griffin* and how she was handled during the storm on Lake Huron in late August of 1679.

It is possible that the vessel also had a small lateen sail, primarily for balance, set on a short mizzenmast behind the mainmast; or it is possible that she was rigged only with mizzen sail and mainsails. Whatever the case, it seems most probable that the mainmast with its topmast was the only important mast on the ship and that the mainsail and main topsail were the most important sails. All other sails and masts were small and could be handled completely from the deck.

APPEARANCE

The *Griffin* was a sailing vessel between 35 and 60 feet in length and of 45 tons burden, rigged with a mainmast, main topmast, mainsail and topsail and probably a small foresail set on a stumpy foremast. She was heavily built —a floating fortress, as she was called by Father Hennepin and some of the Indians who saw her. According to Hennepin, "She carry'd Five small Guns [cannon], two whereof were Brass, and three Harquebrize a-crock [swivel guns for rampart defense]. The Beakhead [a beak-like projection of the bow fastened to the stem and supported by the main knee] was adorn'd with a Flying Griffin, and an Eagle above it; and the rest of the ship had the same Ornaments as Men of War used to have."

The ship as I have reconstructed her is shown on page 3. This reconstruction does not pretend to great accuracy, but it was certainly a vessel something like this in size, construction, and rigging that on August 7, 1679, departed from her anchorage at the east end of Lake Erie and began her long voyage to the upper lakes.

The Voyage of the *Griffin*

The *Griffin* reached the mouth of the Detroit River on August 10 after traveling at least 240 miles. By August 22 she had entered Lake Huron and reached Michilimackinac, or present-day St. Ignace, on August 27, 1679. There she anchored in East Moran Bay. From Hennepin's account of it one can see the pattern of navigation used by the *Griffin's* pilot. He essentially followed the shore line and watched his depth of water by frequent soundings with lead weight and measured line. In the one bad storm encountered on Lake Huron the pilot ordered all sails, yards, and main-topmast removed, and allowed the ship to drift directly before the wind but away from the shore he had been following northward. Also, the *Griffin* was not setting any records for speed, having taken four days to run the length of Lake Erie and six days to traverse the length of Lake Huron.

In early September of 1679 the *Griffin* left Michilimackinac on Lake Huron and sailed westward through the Straits of Mackinac across northern Lake Michigan to an island lying just at the opening into Green Bay, a voyage of about 40 leagues (about 110 miles) according to Father Hennepin. I have elsewhere indicated my reasons for believing that the vessel coasted the north shore of Lake Michigan and came to Summer Island in Delta County, Michigan, and that this was the Island of the Potawatomis lying just at the opening into Green Bay. Here the *Griffin* remained until September 18, 1679. Loaded with furs collected by La Salle's agents during the previous winter, the *Griffin* departed from the Island of the Potawatomis and disappeared with her pilot and crew of five men.

What happened to the ship is not known to this day. But evidence from Hennepin concerning his canoe voyage from the Island of the Potawatomis to the Door County, Wisconsin, mainland on September 19 and the weather conditions for the next six days show that there was a terrific autumnal gale. On the basis of the weather and the sailing habits of the *Griffin's* pilot, I would presume that the vessel encountered a storm between Point aux Barques and Seul Choix Point. At the mercy of wind and wave, in an area with no harbors, she was caught on a lee shore or one of the numerous shoals, where she struck and sank. The remains of the *Griffin* may now lie beneath the waters off Delta or Schoolcraft Counties in northern Michigan.

[1] To do this, I have used specific statements and observations taken from Hennepin's 1698 English edition of his travels as well as some of the data and interpretations of Francis Parkman presented in his book, *La Salle and the Discovery of the Great West*. I have also weighed the statements of Father Hennepin against my knowledge of the archaeology, ethnology, post-glacial geology, and geography of the region. In addition, I have made use of my own experience with boats and navigation, which includes sailing on Lake Huron and Lake Michigan in vessels probably of greater length and draught than the *Griffin;* a voyage in 1939 up the east coast of Hudson's Bay in a freight canoe built by the Indians of Rupert House; and a trip down the east coast of Hudson's Bay in an auxiliary sailing vessel approximating the size and burden of the *Griffin*.

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Report from Malaysia

D. DWIGHT DAVIS
Curator, Vertebrate Anatomy

KUALA LUMPUR, the capital of Malaysia, is a modern city of half a million people, but to the north and east there is excellent tropical rain forest within fifteen miles of the center of town. It is no trick at all to have lunch of rice and roast mouse deer with the aborigines in a forest camp, and be back in town in time for dinner at home. All that is needed is a jeep for transport, and a hot bath to wash the jungle off before dressing for dinner.

This greater gymnure was trapped alive for behavioral studies.

When I accepted an invitation to fill a temporary post in the Zoology Department at the University of Malaya last year, I wondered how much time teaching and administrative duties would leave for my own research program. The Museum needed a reference collection of Malayan mammals and other vertebrates, but making such collections is normally a full time job and it can scarcely be done on a university campus. Besides, ever since I had first encountered them on an earlier trip to Borneo, I had wanted to investigate the behavior of some very primitive mammals that live in Borneo and Malaya—provided they could be trapped alive and transported back to a laboratory.

As it turned out, the Zoology Department of the University of Malaya was an excellent base of operations for such a program. It has fine laboratories and field equipment, and the staff really know the country around Kuala Lumpur, which saved a good deal of the time that usually has to be spent on exploration. The tropical forest is so close to the campus that it was always possible to get out for a few days or hours.

The mammals I wanted for behavioral studies are not exhibited in zoos and few people have ever seen them alive or even know that such creatures exist. They are rather drab-looking insectivores—the greater gymnure (*Echinosorex*), nearly as big as an opossum, and the lesser gymnure (*Hylomys*), not much larger than a good-sized mouse—that somehow survived in the great tropical forests of southeastern Asia long after their relatives became extinct in other parts of the earth. They can scarcely be expected to be handsome, since they are among the most primitive of living placental mammals, but they are of scientific interest because the very first placental mammals must have looked and acted very much like these.

Trying to trap gymnures alive was frustrating at first. We set up a camp in the mountains twenty-five miles behind Kuala Lumpur and put out every trap we had. Gymnures are said to find durian irresistible so we hunted out a durian tree in the jungle and baited traps with the fruit. We offered immense rewards to the aborigines for every gymnure they brought in alive. At the end of six days we had caught one lesser gymnure, and it was dead in the trap. Our luck was even worse at other localities. I began to fear that the work on gymnure behavior would have to be washed out. Then just before Christmas we went back to the original camp and got three gymnures the first day and in a week I had all the material I needed. Their locomotion and feeding behavior are now preserved on motion picture film, and we have embalmed specimens for anatomical studies that will tie in with the data on behavior.

Making forays into the jungle between faculty meetings worked out so well, thanks largely to the geography of the hinterland behind Kuala Lumpur, that the Museum now has a collection of about three hundred Malayan mammals and several hundred amphibians and reptiles. Some are species not previously represented in the Museum's research collections, and others provide good series of forms that were inadequately represented. Several mammals were embalmed at the University of Malaya for later anatomical study at Chicago, and the skeletons of others were preserved. The fact that modern university facilities and rich tropical rain forest are almost side by side at Kuala Lumpur makes the University of Malaya probably the best place in the world for many kinds of tropical research.

Portion of diorama at north end of Hall 29

FEATURED EXHIBIT FOR MAY

Let's Go Uphill To Spring

LOUIS O. WILLIAMS
Chief Curator, Botany

In the northern hemisphere spring comes to the calendar on March 21. We recognize the season not only by the date but by what the plants and, perhaps to a lesser extent, what the animals are doing. Some Chicagoans may equate spring with the arrival of the robins; others of us who haunt the woods in the vicinity may hold that spring is here when the spring beauties, the trilliums, and other early flowering plants are showing their first color.

Judged by what the plants and animals are doing, spring does not come to all places along any given degree of latitude at the same time. On the first morning of spring this year the robins in Chicagoland may well have considered going back south, and about a week later, on Easter Sunday, winter came again. The grass, stimulated by a week of warm weather, was under a blanket of wet snow. In Rhode Island, which is about as far north as Chicago, spring was in evidence on March 21, but westward in the high mountains of Pennsylvania snow was still the order of the day, with below-freezing temperatures at night. Down off the Allegheny Mountains and out into the Central States, spring seemed to have been in the air, even if a bit prematurely. Continuing westward and across the Missouri River into the Prairie States, where the land begins to rise again, the weather got colder as elevation was gained.

We have now added a second "condition" or dimension to spring when we find that elevation, or the lack of it, may retard or advance the arrival

(*Continued on next page*)

of the season.

Farther west along the latitude of Chicago, we discover that when spring —by the calendar—comes to the eastern base of the Snowy Range in Wyoming, the countryside is still held tightly in winter's grasp. If we put on skiis and travel toward the pass across the Snowy Range we will go over snow perhaps five, six or even ten feet deep. Heavy snowfalls are still possible, and even probable, in the high mountains during March and April, and sometimes even into May.

By late July and early August, however, the road is free of snow and we may travel in a half hour, along a beautiful route, from summer upward to early spring.

If at some point on the road we stop the car, we will look out at a scene very much like that depicted in this month's featured exhibit. Spring is arriving at this very moment along the edge of the snow bank to the left of the diorama before us. As we look at the spring flowers along the ridge, and our eyes travel to the right as far as the cliff where the paint brushes grow, we have progressed far into spring. Thus we find at the same place different phases of a single season.

Some of the plants in the diorama belong to the polar world and extend southward only in high mountains. The moss campion (*Silene acaulis*), with its purple flowers, surrounds the polar regions and grows at near sea level in Alaska, Greenland, Labrador, and Northern Europe. When it comes southward it chooses the high mountains as its pathway.

The columbine (*Aquilegia caerulea*), which is near the stunted juniper and spruce along the ridge in the diorama, represents quite the opposite kind of distribution among plants. This columbine is native to and endemic in the Rockies. Here it is at the upper limit of its altitudinal range and very much reduced in size. It reaches its best development perhaps in the valley seen in the distance. The columbine has merely been following spring up the mountain slopes.

Spring is of short duration at this elevation. Spring, summer, and fall may be telescoped into a period hardly longer than a month and even during this time perhaps not a night passes when the temperature does not drop to freezing. Thus the plants that we see in the diorama are, in a sense, very special ones which have reacted to the temperature, the wind, and the short growing season. Although the spruce and the juniper may be fifty years old, they are still very small—dwarfed by the wind, the short growing season, and the temperature. Most of the flowers that we see are relatively large and brightly colored; such flowers attract pollinators more effectively than if they were small and dull-colored. Nature selects rigorously those plants permitted to grow here. There are not many kinds that can withstand the rigors of the locality and have flowers that attract pollinators quickly; or that can grow, flower, and produce seeds in a "spring-summer-fall" which may be but a month or two long.

Before leaving the diorama, look across the way, to the high, snow-covered mountains on the other side of the valley. They are two or three thousand feet higher than our look-out into this alpine world. Fresh snow already covers their upper slopes, and from the chill in the air we feel that winter may not be too long in returning to this flower-covered ridge.

MUSEUM NEWS—

(*Continued from page 2*)

during her childhood in California. She attended Wellesley College and then married. When her husband's business interests brought the family to Chicago Mrs. Grey renewed her interest in biology through the Museum, where she usually worked one day a week.

Her research started with the preparation of a "Catalogue of Type Specimens of Fishes in Chicago Natural History Museum" published in 1947. Later she specialized in the study of deep sea fishes. One of her most important scientific contributions is "The Distribution of Fishes Found Below a Depth of 2,000 Meters" published in 1956. Another important paper, "Revision of the Family Gonostomatidae," which is to appear in Part IV of the *Fishes of the Western North Atlantic*, is now in press. At the time of her death she was working on the genus *Anoplogaster* for the Dana Report.

Mrs. Grey was an amateur ichthyologist whose work was of professional quality. She was particularly conversant with the literature of deep sea fishes and taught herself Russian to keep up with current Russian publications in this field. From this knowledge she always was glad to help beginning student and advanced colleague alike. Hers was a warm, generous personality that will be greatly missed.

A. L. Rand, *Chief Curator of Zoology*

Chicago Natural History Museum
Founded by Marshall Field, 1893
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Chicago, Illinois 60605
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CHICAGO NATURAL HISTORY MUSEUM

Bulletin

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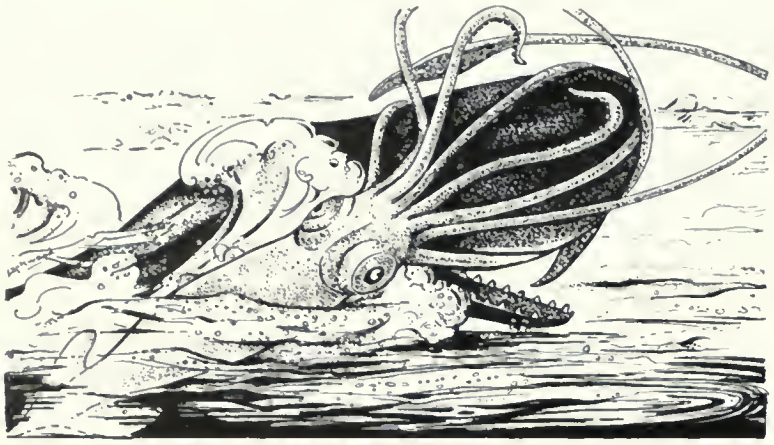
June 1964



Giant Hunters of the Open Sea

FEATURED EXHIBIT IN JUNE

ALAN SOLEM
Curator of Lower Invertebrates

UNFORTUNATELY for legend and romance, the only authenticated account of a dangerous attack made by a giant squid against a ship involved a rowboat fishing off Newfoundland in October, 1873. After a young boy chopped off a 19-foot piece of one of the squid's tentacles, the animal was repulsed and the boat was then rapidly rowed to shore and fame as carrying the first actual portion of *Architeuthis* to be brought to the attention of scientists. Thus the delightfully horrible pictures of squids attacking sailing ships, such as the one on our cover, take their place, with drawings of dragons and unicorns, on the shelf of discarded zoology; but unquestionably the giant squid remains one of the wonders of the animal world.

Although dwarfed in size by the 120-foot blue whale—the largest living vertebrate—giant squids are the largest known invertebrate animal, probably reaching a total length of 60 feet. The giant jelly-fish *Cyanea* of the North Atlantic and Arctic waters does have a six-foot wide float with arms that dangle 100 or more feet, but this colonial animal is 95 per cent water and drifts passively with the currents. Small 30-foot specimens of the giant squid have been known to weigh over 400 pounds, but no large individuals have ever been placed on a scale. Hence their maximum bulk can be only a matter of speculation.

Squids are close relatives of octopuses, cuttlefish, and the chambered nautilus, and belong to the same phylum as clams and snails. Clams are specialized filter feeders, straining their food out of the water, while snails crawl about or weakly swim after their food. The cephalopods, to which octopuses, squids, and cuttlefish belong, are specialized for active pursuit of their prey and have developed acute vision and a form of jet propulsion to aid in their search for food.[1]

Undoubtedly many of the early tales of sea monsters were based on random sightings of *Architeuthis*. In 1555 the Swedish Catholic Bishop Olaus Magnus published a highly exaggerated but clearly recognizable account of giant squids. Numerous subsequent references to "krakens" in Scandinavian literature were inflated by others until Denys de Montfort, a French zoologist, created the "poulpe colossal" that attacked and sank warships! By pure coincidence, it was a French warship in 1861 that provided one of the first reliable accounts of a "kraken." For three hours the crew of the *Alecton* attempted to shoot, harpoon, and net a giant squid. They did get a noose around the body, but managed only to pull the tail off with the rest sinking beneath the surface.

Not until the above-mentioned attack on the rowboat was there tangible proof of the giant squid's existence. Late in that same year, a large specimen was netted by other Newfoundland fishermen. A local naturalist measured its length as 32 feet and photographed it. The next ten years saw perhaps 50 to 60 specimens stranded on the shores of Newfoundland, more than have ever been found subsequently.[2] Whether they were poisoned by some unusual algal bloom or were the victim of some unknown disease is a problem that will never be answered.

Occasionally today a specimen is stranded or netted. A small individual, 30 feet in total length, was taken at Ranheim, Norway, in October, 1954 (see photograph on page 3).

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[1] A good popularized account of these interesting animals is given in *Kingdom of the Octopus* by Frank Lane, published by Jarrolds, London, in 1957.

[2] Many of these stranded specimens were studied in detail by A. E. Verrill of Yale University. His studies, published in 1879 and 1881, still provide most of the information recorded about *Architeuthis*.

The two very long tentacles (folded back upon themselves in the picture) account for most of the body length and probably are used to grasp food. The shorter, more muscular arms presumably hold the prey still and bring it to the beak-like mouth.

We know the "kraken" exists, but we know nothing about how it lives. Our specimens come from the stomach of sperm whales, dying animals stranded on beaches, or the rare capture in a net. Presumably the squids live at moderate depths of the open sea, but they do not have the structures associated with fast-swimming species and may actually be rather sluggish feeders on animals of the continental slopes. This conclusion, however, does not agree with the finding of numerous squid sucker marks on sperm whales (which feed on squids) or with the experience of Commander Arne Groenningsaeter of the Royal Norwegian Navy. On three different occasions he saw squids, moving at an estimated 20 miles per hour, overtake and ram into the 15,000-ton tanker *Brunswick*, reach up the side with their tentacles and then slip back to be caught by the propeller.

Whether *Architeuthis* is a meek giant feeding on slow-moving small animals of the sea bottom, or the speedy, fierce "kraken" of legend is an unanswerable question at the present time. The few tales of battles of sperm whales and squids must be classified as unproved "fish" stories, even though the power of the beaks and tentacles of the squids is so formidable that such tales *could* be true.

The rich waters of the Humboldt Current off Peru swarm with fish and also enormous numbers of the squid *Ommastrephes gigas*. Reaching 12 feet in length and weighing more than 350 pounds, this animal is a strong competitor of fishermen. Hooked tuna are often stolen by these squids, which sometimes bite through even the heaviest wire leaders. At night the squids are attracted to lights on the boats and appear in vast schools.[3]

Most squids are much smaller, and feed on crustaceans and small fish. About 350 species are known, with the majority less than two feet in total length. Exquisitely crafted glass models of nine species are on display in the Hall of Lower Invertebrates, on the Museum's ground floor, together with models of three cuttlefish. Suspended from the ceiling is a life-size model of a giant squid that was washed ashore in Newfoundland in 1877. A model of a giant octopus also hangs in the hall. These exhibits of cephalopods constitute the Museum's exhibit-of-the-month for June.

Today, a giant squid is an uncommon find, with only a very few ever stranded or netted. This small individual, 30 feet in length, was taken at Ranheim, Norway, in October, 1954.

[3] See *The National Geographic* for March, 1941, pp. 373–400.

THIS MONTH'S COVER: *Our Cover, a portion of an old woodcut taken from* The Monsters of the Deep: and Curiosities of Ocean Life, *printed in 1875, dramatically portrays a legendary attack by a giant squid on a sea vessel. Although such mythical notions about the giant squid have long been discarded, to this day very little is known of how the giant sea creature lives.*

1. The beginning of an exciting evening: new arrivals consult their programs.

2. First exhibit to catch the eye is the model of a new facility for basic scientific research and graduate education which the Museum will construct under a grant of $875,200 from the National Science Foundation. Lido Lucchesi, Museum artist-preparator, shows his model of the building addition.

3. Then on to Anthropolo pared for display in a new trumpet once used by lamas

MUSEUM'S

5. Next stop is Geology, where Chief Curator Zangerl reconstructs the history of fishes living 285 million years ago. Research in the Department of Geology will be greatly aided by special laboratories provided in the new building addition.

6. Various extremes in the sizes and shapes of bone hibit displaying the humerus of such diverse animal swan, gibbon, shrew, anteater, and man.

examine a fabulous collection of Tibetan cultural materials being pre-
-and a once-in-a-lifetime chance to sound the deep notes of a telescopic

4. Proceeding to Botany, Members learn how lowly algae may provide vital oxygen for moon explorers.

ANNUAL "OPEN HOUSE"

Attracts 2,262 Members

who explore man and his world

rough the aid of Museum research

demonstrated in a Zoology ex-
rhinoceros, giraffe, manatee,

7. Evening's end: refreshments in Stanley Field Hall

CHICAGO NATURAL HISTORY MUSEUM

News

CLIFFORD C. GREGG RETIRES AFTER 38 YEARS; NEW PRESIDENT IS JAMES L. PALMER

At the May meeting of the Museum Board of Trustees, Dr. Clifford C. Gregg, President, announced his plans to retire on June 1. The Board, after accepting the resignation with a resolution of profound appreciation for Dr. Gregg's long and distinguished service to the Museum, elected Mr. James L. Palmer, formerly First Vice President, as the fifth President of the Museum.

Mr. Palmer retired recently as President of Marshall Field & Company. His first position with the company was as a consultant in 1936, and he carried various executive responsibilities between then and 1949, in which year he was elected President. He became chief executive officer in 1958.

Prior to his association with Marshall Field & Company, Mr. Palmer was a member of the faculty of the University of Chicago School of Business, from 1922 to 1936. During this period he also served as a consultant to various corporations.

Mr. Palmer is a Director of Marshall Field & Company, International Harvester, Harris Trust and Savings Bank, and the General Candy Corporation. Among his civic activities have been various assignments in government, the Community Fund of Chicago, and the Chicago Lighthouse for the Blind. He is a Trustee of the Chicago Sunday Evening Club, a Fellow of Brown University, a Director of Federal Prison Industries, Inc., and a Director of the Chicago Area Committee.

Mr. Palmer holds a Bachelor's degree from Brown University, a Master's degree from the University of Chicago, and a C.P.A. degree from Illinois. He served in the U. S. Navy in the first World War.

In accepting the Presidency of the Museum, Mr. Palmer stated, "In a sense I am returning to a first love, the field of education. I found my career in university work most enjoyable and rewarding, and I expect my work at the Museum to be equally stimulating. Stanley Field through the past 55 years, aided by Dr. Gregg during the past 38 years, has built a great educational institution on our lake front. Like all such institutions, it must continue to grow and progress if it is to keep pace with our changing and expanding society. In these times no worthwhile university or museum can stand still, financially or otherwise. I regard as a great personal challenge the opportunity to help extend and broaden the research and educational services of Chicago Natural History Museum, already one of the four or five great natural history museums of the world."

STANLEY FIELD
President, 1909 - 1961
Chairman of the Board, 1962-

CLIFFORD C. GREGG
President, 1962 - 1964

JAMES L. PALMER
President, 1964 -

Dr. Gregg joined the staff of the Museum in February, 1926, as Assistant to the Director. He was elected Director in May, 1937, and continued in that office until January, 1962, when he was elected President. In that position he succeeded Mr. Stanley Field, who was elected Chairman of the Board after 53 years of service as Museum President.

In announcing his retirement Dr. Gregg expressed to the Board his deep appreciation of the privilege of serving the Museum for more than 38 years. "Especially," he said, "I want to express my gratitude to Mr. Stanley Field, who is responsible for my early training at the Museum and who has been a most loyal supporter at all times. Without his guidance the Museum would never have reached the position of world-wide eminence which it now enjoys."

Dr. Gregg has been active in other civic and philanthropic affairs. He is a past president of the YMCA of Chicago and is currently a member of its Board of Managers and its Board of Trustees. He has also been President of the National Council of YMCAs in the United States, is a member of the Executive Committee of its National Board, and is a member of the Board of Trustees of George Williams College. In World War II, he advanced to Colonel, General Staff Corps, while on leave from the Museum. He retired as a Colonel, U.S.A.R., in 1955.

The years of Dr. Gregg's service as Director and as President were among the most productive in the Museum's history. In 1939 with the financial backing of President Stanley Field and Mr. Marshall Field III, the Museum employees' pension plan was established—one of the early museum plans in this country. The number of employed per-

sonnel increased from 166 in 1937 to 236 in 1963. A dynamic program of exhibit modernization was carried forward with the interest and support of President Field and maintained the Museum's reputation as a leader in exhibition. In this period 125 expeditions and field trips were conducted in more than 40 countries, reaching every continent except Antarctica; and more than 150 field projects were undertaken within the United States.

The largest single foundation grant in the history of the Museum, received in 1963 from the National Science Foundation, provided funds to construct a building addition that will greatly enlarge the Museum's capacity for research and education. As the Museum plans for the future, it is with genuine appreciation for his contribution to the growth and strength of the Museum that we wish Dr. Gregg well in his retirement. It is fortunate that Dr. Gregg's years of experience will be available through his continued service on the Museum's Board of Trustees.

E. L. W.

Orville L. Gilpin (left), *Chief Preparator of Fossils, and Harry E. Changnon, Curator of Geology Exhibits, unload a shipment of Walker Collection specimens. About a thousand trays of fossil specimens have arrived at the Museum since the first of the year; shipment of the complete collection of more than a million specimens is expected to continue at two- or three-week intervals throughout the summer.*

MUSEUM RECEIVES $875,000 GRANT

On members' night, Mr. Stanley Field, Chairman of the Board of Trustees, announced that the Museum has received a grant of $875,000 from the National Science Foundation, which will be used for new construction to enlarge facilities for basic scientific research and graduate education.

Recently a booklet describing the new construction was sent to all Members. Of the four scientific departments, the Department of Geology will be affected most by the expansion. New and remodeled areas to be provided for geological research include a diagnostic X-ray unit for the radiographic study of rocks and fossils; a photographic laboratory; a rock-sectioning laboratory, and a thin-sectioning laboratory. The Chalmers Mineralogical Laboratory will be enlarged, as will the paleontology library. A classroom for lectures and seminars, study rooms for graduate students, and workrooms for visiting scientists are also to be added. Storage space for the Department's scientific collections will be approximately doubled. An estimated one-third of the 250,000 cubic feet of added space is designed to connect directly with the present Library, and will be used primarily for additional book stacks.

The new construction alleviates a long-standing space shortage that became critical when the University of Chicago proposed the merger of its famous Walker Collection of fossil invertebrates with the Museum's paleontology collections. In accepting the merger, Museum Director E. Leland Webber stated: "The addition of the collection to the Museum's geological holdings, together with the new construction, will create an outstanding national center for research on fossil invertebrates. We welcome this opportunity for greater research based on the Walker Collection and for continued close collaboration with nearby universities."

STAFF NOTES

Paul Martin Honored

Dr. Paul S. Martin, Chief Curator of Anthropology, was elected President of the Society for American Archaeology at its annual meeting held recently in Chapel Hill, North Carolina. The Society is the leading professional association of archaeologists in the United States.

For the past thirty years Dr. Martin has headed Museum expeditions to the southwestern part of the United States, where his work has made possible the reconstruction of several prehistoric Indian cultures. Many of the Museum's exhibits on life among the Indians of New Mexico and Arizona before Columbus are based entirely on the original discoveries of these expeditions. His field schools, conducted each summer at the site of his digs, provide an outstanding opportunity for the archaeological training of high school and college students.

In 1960, Dr. Martin was responsible for the discovery and excavation of a large kiva, or ceremonial chamber, in which an unusual sacred image was worshipped. The stone god, found in a carefully constructed crypt within the great kiva, furnished new evidence concerning the religious beliefs and ceremonies of the Pueblo Indians who lived in Arizona from A.D. 1250 to 1350.

Currently Dr. Martin is using computers to analyze archaeological debris collected by the random sampling of prehistoric Indian sites. Through such computer analysis "the study of extinct cultures can now go far beyond description," he recently wrote. "We can ask new questions about the life of prehistoric peoples—questions that were never before possible. Years ago we used to think that archaeology could not recover data on the social organization of an extinct people. We now know it can. These sorts of questions are the real

(*Continued on next page*)

'stuff' of archaeology for me; and I think we are on the threshhold of an exciting breakthrough in the study of prehistory."

Collier Gives Talk

RECENTLY the Extension Division of the University of Minnesota presented Dr. Donald Collier, Curator of South American Archaeology and Ethnology, in a public lecture on the Incas. Dr. Collier was one of nine specialists from all parts of the country who were invited to Minneapolis to participate in a series of talks on the high cultures of Latin America.

Inger Conducts Seminar

DR. ROBERT F. INGER, Curator of Amphibians and Reptiles, conducted a seminar on the campus of the University of Iowa in which he reported some of the findings uncovered in his current ecological studies on the amphibians and reptiles of the rain forests of Borneo. Attending the seminar were faculty and students of the university's Department of Zoology.

Clark On Study Trip

DR. JOHN CLARK, Associate Curator of Sedimentary Petrology, is spending six weeks traveling through South Dakota, Nebraska, and Wyoming to gather information on the paleo-climatic history of those western states.

Dr. Clark reported on his research on ancient climates in a series of two articles that appeared in the February and March BULLETINS this year. These studies have enabled him to make predictions concerning climatic changes likely to occur around the world in future years.

Artist Rejoins Staff

WALTER BOYER, former Ceramic Restorer in the Department of Anthropology, has rejoined the staff as an artist in Botany after leaving the Museum three years ago to devote more time to his personal artistic pursuits. His first work for the Department of Botany will be in the new Hall of Useful Plants, now in process of installation, as well as general exhibition and renovation. Boyer is a graduate of the School of the Art Institute.

New Book Shop Manager

NEW MANAGER of the Museum's Book Shop is Mr. Uno M. Lake, who comes to the Museum from a managerial position with Fred Harvey. A graduate, in business administration, of Lake Forest College, Lake also has worked for 13 years for Marshall Field & Company.

The new manager replaces Mrs. Jane G. Comiskey who managed the Book Shop from 1957 to 1964.

PRIZE-WINNING GEMS ON DISPLAY IN JUNE

JUNE 1 marked the opening of the 14th Annual Amateur Handcrafted Gem and Jewelry Competitive Exhibition featuring outstanding examples of lapidary art. Exquisite cut gems, jewelry of original design, collections of polished stones, and decorative objects ingeniously fashioned from rock materials comprise the display located in Stanley Field Hall. All are prize-winners in the Chicago Park District's 1964 amateur lapidary competition.

The exhibition demonstrates how skilled craftsmen can transform not only precious and semi-precious stones but common rocks, as well, into objects of rare beauty. The exhibit will remain on display through July 5.

"NATURE MAGIC," NEW JOURNEY FOR CHILDREN

A FULL-SCALE investigation of some of nature's wizardry will get underway in the Museum on June 1, the beginning date of the new children's Journey for summer, "Nature Magic."

Emphasis of the Journey will be the role played by pigments and prisms in the creation of the wide variety of ever-changing colors that occur in the world of nature. The Journey will guide the way to exhibits on: unusually colorful forms of life found in the oceans; insects of brilliant and changeable color; and birds whose plumage reflects the entire range of the color spectrum.

Children who would like to take the summer Journey need only pick up an instruction-questionnaire at either of the Museum doors, or Information Desk, and then follow closely the directions given.

Summer Hours

Beginning July 1 and continuing through Labor Day, the Museum will observe longer hours of 9 A.M. until 8 P.M. on Wednesday, Friday, Saturday, and Sunday. On those evenings the cafeteria will serve dinner from 5 to 7 P.M. Hours on Monday, Tuesday, and Thursday remain 9 A.M. to 6 P.M.

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CHICAGO NATURAL HISTORY MUSEUM
Bulletin
Vol. 35 No. 7
July 1964

Scientists aboard the research ship "Anton Bruun" survey fishes of the Indian Ocean (see page 4).

JULY FEATURED EXHIBIT

Chicagoland's Reptiles and Amphibians

Robert F. Inger
Curator, Amphibians and Reptiles

Six-lined race runner
(Cnemidophorus sexlineatus)

THE Chicago area is remarkably rich in reptiles and amphibians, considering how far north it is. Within 70 miles of the center of the city live 10 species of salamanders, 11 frogs, 18 snakes, and 10 turtles, but only 3 lizards. We evidently are beyond the northern limits for most lizards. By comparison, all of France, which is larger than any of our states except Alaska and Texas, has only 48 species of reptiles and amphibians.

Left: Marbled salamander (Ambystenia opocum)

Right: Fox snake (Elaphe vulpina)

The explanation for the relative richness of our local fauna probably lies in the fact that the Chicago area is at the junction of several climatic and vegetation zones. Animals, because they are usually adapted to living in one kind of environment, tend to be distributed according to these zones.

We are accustomed to think of Chicago as a transportation center, a juncture point for traffic from all directions. Actually, the Chicago area has had the same role in connection with movements of animals. A number of species are associated with the mixed deciduous-coniferous forests of the northeastern United States which just reach our area. The red-backed salamander, the four-toed salamander, and Blanding's turtle are examples of amphibians and reptiles that have spread to Chicago via that environment. The hog-nosed snake, the marbled salamander, and the mud turtle probably moved into Chicagoland along with the more southern deciduous forests that extend up the Wabash valley. A few, such as the plains garter snake, the fox snake, and the bull snake, have come in by way of the tongue of prairie that reaches the Chicago area from the west.

A series of four cases in Hall 18 (Hall of Reptiles) displays the species of reptiles and amphibians of Chicagoland. Exhibits of this sort comprise one of the ways in which the Museum presents the natural history of our region to the general public. Another, equally important way the Museum uses to carry out this responsibility is through the publication of leaflets and books.

This month the Museum reprinted *Amphibians and Reptiles of the Chicago Area* by Clifford H. Pope. The book was first printed in 1944 while Mr. Pope, who has since retired, was still Curator of Amphibians and Reptiles.

Intended as a guide for local naturalists, the book describes and illustrates all 52 species of frogs, salamanders, turtles, lizards, and snakes found in the Chicago area. In addition, Mr. Pope has summarized all that is known about their habits and occurrence. Because many of these same species are found over large parts of the north-central states, this guide will be valu-

able to interested persons living at some distance from Chicago: for example, in Davenport, Milwaukee, Detroit, and Cleveland. This excellent little book should be in the library of every local naturalist and biology teacher. It is available through the Museum Book Shop. (END)

A World of TIME

Edward J. Olsen
Curator, Mineralogy

If you were asked to construct a clock you would probably throw up your hands at the vision of tiny interlocking gears, springs, wheels, and bearings. It might not, however, be such a difficult job. There are many kinds of clocks. All that is required is a regularly spaced sequence of events to mark the passage of time.

The Romans simply used dripping water. Even today many housewives measure the time required to cook an egg by turning over a pinched glass tube containing fine sand—a three-minute version of the ancient hourglass. The picturesque sundial seen in many gardens measures time by the movement of the shadow of the fixed arm across the face of the dial. It is, essentially, a clock with no moving parts at all. Finally, the experienced woodsman, prospector, trapper, or farmer can usually tell you the time of day within fifteen minutes by simply seeing the position of the sun in the sky.

Now let us consider a less obvious kind of clock. Suppose we had a large box with 6,400 green marbles in it. Then imagine that by some process in exactly one year half of the marbles had turned red. This leaves 3,200 green ones and 3,200 red ones. Suppose that in one more year half of these remaining green ones become red, leaving 1,600 green and a total of 4,800 red. If the process continues in this manner we may then construct a table.

TABLE I

Passage of Time	Green	Red	Red Divided by Green
0	6,400	0	0
1 year	3,200	3,200	1
2 years	1,600	4,800	3
3 years	800	5,600	7
4 years	400	6,000	15
5 years	200	6,200	31
6 years	100	6,300	63
7 years	50	6,350	127
And so on			

If we know that this process goes on with regular precision, we could look at such a box, count the reds and greens and then say how long the marbles had been sitting there. For example, if we found 6,200 red ones and 200 green ones we could say that the process had been going on for five years. In fact, we need not necessarily go through the trouble of counting all the marbles. The right-hand column in the table shows the quotient of reds divided by greens. Thus, we need only take out a random sample of a few hundred marbles and count the reds and greens, divide the former by the latter and, if our sample is average, we should obtain a value close to 31—a time of five years. This process goes on until the last green marble has shifted to a red color. At that time the clock may be considered to have "run down."

What we have just described, in a fairly simplified form, is the so-called "atomic clock" upon which the much publicized methods of radioactive dating are based. Rather than by marbles changing color, the actual atomic clock operates by atoms changing to other atoms. The time required for half the population of atoms of one kind to change to another kind is called the *half-life*.

Before going on let's look once more at the box of marbles to clear up another definition. Let us imagine that every time a green marble converts to a red one it gives off a loud clicking sound. During the first year we would observe 3,200 clicks, or an average of around 62 per week. This is moderately noisy. During the second year, however, there would be only 1,600 clicks, with 31 per week on the average. During the third year there would be only 800 clicks, or about 15 per week; and so on. Thus the rate of noise-making would drop off year by year until it finally stopped. At any time during the life of this clock we would have a definite noise level. This we call the level of *activity*. In the case of atoms this is called the level of *radioactivity*.

So far then we have two methods to measure time. We might, as mentioned before, count a sample of red and green marbles and figure the time from that; or we might simply count the number of clicks per week, or per day, etc., and figure the time from the rate at which they are being produced. In the first method we need *not* necessarily know how many green marbles were present in the beginning since we are only measuring the quotient of reds divided by greens, which will be the same no matter how many greens were there originally (if you don't believe me you might give it a try, starting with, say, 10,000 green ones). We need to know only the half-life, which in this example is one year. In the second method, however, we have to know the original population of greens in order to correlate the level of activity with the age of the system.

From what has been described already we can now say something about the efficiency, or value, of such atomic clocks.

(*Continued on page 6*)

THIS MONTH'S COVER

SURVEY FISHES OF INDIAN OCEAN

Museum

After half a year on the least known of all oceans, the Indian Ocean, Loren Woods is back home again at Chicago Natural History Museum.

The Museum's Curator of Fishes left Chicago in November, 1963, to join the International Indian Ocean Expedition, a cooperative scientific venture sponsored by UNESCO and the United States Program in Biology. For this undertaking the efforts of 12 nations have been enlisted in a two-year survey of the entire Indian Ocean.

Almost as large as the north and south Atlantic Oceans combined, the Indian Ocean is considered a mystery from the standpoint of scientific knowledge. This situation carries commercial implications, since the countries bordering on the Indian Ocean depend on fish as a major source of food. Any knowledge that will make possible an increase in the harvest from the sea will greatly aid the economies of these countries. It is hoped, therefore, that the expedition will uncover information that will expand the effectiveness of the fishing industries.

Woods joined the Indian Ocean survey in Bombay, India, where he boarded the research vessel, *Anton Bruun*. From Bombay, the *Bruun* charted a zig-zag course along the continental shelf to Karachi, continued to the Gulf of Oman, then south along the Arabian coast, and back again to Karachi. From Karachi Woods flew back to Bombay to study fishes previously taken by the expedition, and then proceeded to Mandapam Camp.

Located on an Indian peninsula that juts out toward Ceylon, Mandapam Camp is maintained by the Central Marine Fisheries Research Institute and is equipped with a laboratory, library, and other research facilities. Woods spent two and one-half months there, collecting shore fishes, studying specimens, and recording his findings.

At the end of February, he departed for Colombo, Ceylon, to meet another of the expedition's research vessels, the *Te Vega*. On this ship he traversed parts of the central and southern Indian Ocean with stops at Galle, Ceylon; various atolls of the Maldive Archipelago; Cochin, India; and Mauritius.

Many of the fishes collected by Woods are now beginning to arrive at the Museum. If the first part of the scientific project was demanding physically —requiring months of diving, trawling, and specimen-preserving on a seven-day-a-week schedule—the second part is just as demanding mentally. For Woods, the arrival of the Indian Ocean collection marks the start of months of careful sorting and identification of specimens. This is the spade work that must be accomplished before further research can be begun.

New Exhibit Reveals Beauty of Weeds

Weeds, the unwanted guests of our gardens and cultivated fields, rarely are appreciated for their beauty.

An exhibition of water color paintings of weeds opening at the Museum on August 1 reveals the unsuspected loveliness of even the most common varieties found in backyards and along waysides. The paintings are by Mary Virginia Roberts, a San Francisco artist, who hopes through her art to dispell the notion that weeds are ugly.

Miss Roberts has shown her water colors at the California Academy of Sciences, the Los Angeles County Museum, the Hall of Flowers in Golden Gate Park, the Pacific Coast Club, and a number of other galleries on the West Coast.

The exhibition will be displayed through September in Hall 9 on the ground floor.

SUMMER VISITORS

Summertime always brings to the Museum many distinguished visitors from all over the world. Last month, Mr. John Ngu Foncha, Vice President of the Republic of Cameroon, made Chicago Natural History Museum one of the few stops on his brief tour of Chicago. He came with a delegation of officials from the Cameroon government to see the Museum's African exhibits. Museum Director E. Leland Webber and Phillip Lewis, Curator of Primitive Art, greeted Vice President Foncha and accompanied him on his tour of the exhibition halls.

A few days later, Sultan Seidou Njoya Njimouluh and Queen Ramatou Ngamdomboue of Foumban, Cameroon, arrived in the city. This contemporary African ruler and his queen were partic-

News

Dr. Louis O. Williams, Chief Curator of Botany (left), and Professor P. Maheshwari of India, study exhibits in the new Hall of Useful Plants.

ularly interested in the Museum's reconstruction of an earlier African king's house. This exhibit reproduces the dwelling of a grasslands tribal ruler at the turn of the century, when Cameroon was a German protectorate. The exhibit was of special interest to Sultan Njimouluh because his tribe of 130,000, the Bamoun, is of the grasslands region.

As a noted collector of Cameroon art and sculpture, Sultan Njimouluh was also pleased at the opportunity to examine the Museum's research collection of Cameroon art and other ethnological materials. This collection, which is not on display, numbers almost 2,000 pieces and is considered one of the finest in the world.

Another distinguished visitor last month was Professor P. Maheshwari, head of the department of botany of the University of Delhi. A well-known plant morphologist, Professor Maheshwari was here to gather material for his forthcoming volume on the morphology of gymnosperms. He also spent a considerable time studying the Hall of Useful Plants (Hall 28)—currently being reconstructed—to gain ideas that may be used in exhibition work in India.

(*Continued on page* 8)

Center: Sultan Seidou Njoya Njimouluh and Queen Ramatou Ngamdomboue, tribal rulers from Cameroon, examine African art in the Museum's research collections.

Right: Museum Director E. Leland Webber (left) tours the African exhibits with Vice President John Ngu Foncha, Mrs. Foncha, and a delegation of Cameroon government officials.

A World of TIME

(*Continued from page 3*)

If the half-life is only a year, or an hour, or, as in the case of some atoms, only a few seconds, it is obvious that such clocks will "run down" in a short time and be of little value. To use such "weak-springed" clocks we have to have an extremely delicate chemical method to analyze exactly the number of green atoms and red atoms. Once the number of green ones has fallen below our ability to separate them in the laboratory, the clock is, for all purposes, dead even though there might be some few green atoms still present. The same is true if our ability to detect the "clicks" per unit of time is limited by our laboratory devices.

We may now depart from "greens and reds" and mention a few actual examples of these atomic changes. Consider the mineral called orthoclase. This is one of the most common minerals in granite, the rock which makes up almost all of the earth's crust. Chemically, orthoclase contains atoms of the element potassium. When a crystal of orthoclase forms, 99.9 per cent of the potassium in it is atomically stable and no changes occur at all. However, less than one-tenth of a percent of the potassium atoms consist of the unstable atom called potassium–40. Chemically it is almost identical to the other potassium atoms in the crystal except that its atomic nucleus is not stable and tends to break down in time. It breaks down to the element called argon–40, which is very stable and undergoes no further changes. During the breakdown of potassium–40 several invisible, high energy rays are given off also. These rays, when passing through a sensitive device such as the well known Geiger counter, produce brief electrical discharges which, when amplified, come out as clicks in a set of ear phones.

Potassium–40 is an excellent clock for two reasons. First, its half-life is one billion, 320 million years; thus it requires a long time to run down. Second, the mineral orthoclase is very common in the earth's crust so that samples are usually easy to obtain in regions where age determinations are desired. In addition, the black mica mineral called biotite is almost as common in granites as orthoclase. It also contains significant amounts of potassium. Because of the long half-life, the potassium-argon clock is used to measure ages of rocks (and meteorites)) ranging back to four and one-half billion years old—approximately the age of the earth. In using this method the common procedure is to measure a sample of potassium–40 and argon–40 and compute the age from the quotient.

Within the past ten years much publicity has been given to the method of carbon–14 dating. The carbon in a sample of wood, coal, bone, etc., will contain less than one one-hundredth of a percent of the unstable atom carbon–14 when the sample is formed. After a half-life of only 5,700 years, carbon–14 converts to the stable atom called nitrogen–14. In the case of this clock, we know with precision the amount of carbon–14 that will be incorporated, say, into a tree trunk at the time it was growing. In similar fashion to the potassium atom discussed above, the carbon–14 atom, when it breaks down to nitrogen–14, emits a high energy ray which can be detected by a sensitive instrument as an amplified "click." Rather than measure the quotient of carbon–14 to nitrogen–14 it is simpler to measure the clicks (radioactivity level) to obtain the age of the sample.

Because of the short half-life of carbon–14 it is suitable only for relatively young samples. How far back the method can be pushed depends on our ability to measure faint radioactivity levels. At present the method is good only for specimens younger than about 30,000 years in age. Geologically, 30,000 years is only "yesterday" to an earth that is about four and one-half billion years old. However, for age determinations of anthropological or archaeological interest, carbon–14 dating is a valuable tool. For example, archaeologists reckon the age of the tomb of the Egyptian, Sesostris III, as 1800 B.C. Carbon–14 tests give a date of 1670 B.C. The tomb of the Egyptian vizier, Hemaka, has been estimated by archaeologists to have been built sometime between 2750 B.C. and 3150 B.C. Carbon–14 tests give a date of 2933 B.C.

So far we have mentioned only the two most popular methods for geologic age determinations. But what happens in those cases where the rocks contain no potassium or carbon? Fortunately, there are other atoms available as clocks to fill in the gaps. A partial list is shown in Table II.

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Members are requested to inform the Museum promptly of changes of address.

The drawing shows the age of various rock belts within the North American continent. From the map, the time sequence of the continent's growth can be determined.

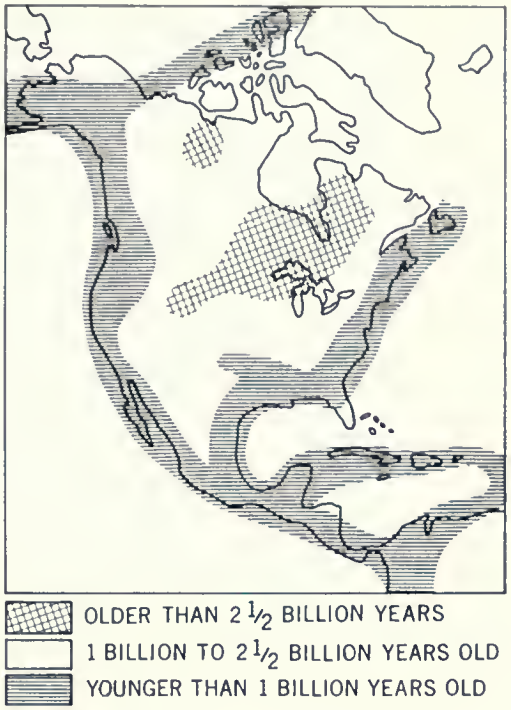

TABLE II

Atom	Product	Half-Life (millions of years)
Uranium–238	Lead–206	4,500
Uranium–235	Lead–207	710
Thorium–232	Lead–208	13,900
Rubidium–87	Strontium–87	60,000

In looking at this list the reader may wonder how half-lives of such long duration are determined. Some of those listed are longer than the age of the earth, and are fantastically longer than the time man has been studying them (it is only about 60 years since the discovery of radioactivity). In general, half-lives are determined by chemically extracting a small mass of a radioactive material (for example, uranium–238) and then measuring the very slight drop in activity over a period of several years. When the drop in activity is plotted on a graph against time, the half-life may be measured from the slope of the line. Obviously then for some of the very long half-lives (such as rubidium–87 at 60 billion years) this method is less accurate than for shorter half-lives (for example, uranium–235 at only 710 million years). As a consequence some of the half-lives are known only approximately. Some of the current atomic research is devoted to the more accurate determination of long half-lives.

Besides the pairs of atoms listed in Table II, new pairs are being investigated by research laboratories all over the world, so that ultimately almost any kind of rock will have some atoms in it that can be used for age determination. We might mention that all of these methods involve extremely delicate and costly laboratory procedures. If one were to believe some of the accounts mentioned in the popular press one would conclude that there is some magical machine in which you place a sample and an age comes out on a printed tape. In reality, depending on the method used, a single age determination can require the work of two men for as little as a couple of days to as much as several months.

Finally, we must point out that dating methods cannot be used blindly. Consider the case of a granite ledge containing the mineral orthoclase, which crumbles away by weathering. The orthoclase grains may be carried in streams down to a lake where they settle to the bottom and are covered by mud. The muddy sediment is compressed and eventually hardens into rock. Let us assume that this rock is one million years old today. If we were to collect some of it, pick out the orthoclase, and measure the age by potassium–40, we would conclude that the rock was two billion years old. We would be wrong by 2,000 times! For what we would have measured is the age of the original granite which lay miles away.

Next let's consider a granite that is one billion years old and is undergoing the geologic process called metamorphism. Suppose that the orthoclase gradually recrystallizes to the potassium mineral called biotite (black mica). In the process, all the argon–40 that was formed in the orthoclase is lost. If we were to take a sample of the biotite and measure its age by the potassium–argon method we would find that it is perhaps only 70 million years old. What we would have dated is the time when the metamorphism took place; that is, when the original granite was metamorphosed, the potassium–40 clock was "reset" and started afresh. Thus only by good geologic sense in collecting samples can we know what dates we are getting. Any geologist would know, in the latter case, that he was obtaining the age of the metamorphosed rock, and would use the data accordingly. In the former case, he would probably never have collected the orthoclase from the muddy sedimentary rock in the first place.

From the methods discussed above has emerged, gradually, a set of geologic ages which when plotted on a map illuminate the time sequence of the growth of whole continents. On this page is a slightly simplified map of the age belts in North America. From it we see that North America started with an ancient core region in central Canada over two and one-half billion years ago. The core has surrounded itself by successively younger belts and has grown larger in the process.

The extreme ages shown on such a map are generally beyond our ability to comprehend, except in the sense of making our own lives appear ridiculously short. One can only feel small in a world where the gravel in one's driveway may be one billion years old!

(END)

MUSEUM NEWS

(*Continued from page 5*)

WHALE STUDY COMPLETED

THE Curator of Mammals, Dr. Joseph C. Moore, left Chicago flying east, bound non-stop for London, on September 15, and returned from the west on March 14.

The intervening six months were the culmination of a dream he had entertained for several years: to travel to other museums around the world where specimens of a certain genus of rare beaked whales were available for study. He had already studied the specimens in North American institutions. The six-month trip, made possible by a grant from the National Science Foundation, extends the scope of his study world-wide.

After six weeks of work in the British Museum, exploring the largest collection of these whales in the world, to discover new taxonomic characters, Dr. Moore went on to eight other institutions in Europe, two in South Africa, one in Ceylon, five in Australia, six in New Zealand, two in Japan, and one in Hawaii. In California, he tested his discoveries on specimens in two museums.

This route, incidentally, enabled him to drop in for dinner with the Museum's Curator of Comparative Anatomy, D. Dwight Davis, in Kuala Lumpur, Malaysia, and to enjoy the delights of *salay* at a sidewalk cafe. Dr. Moore also met with the Associate Curator of Fossil Mammals, William D. Turnbull, in Melbourne, Australia.

Back in Chicago, with many pages of data, Dr. Moore is delighted with the results of his trip. The people in other institutions around the world were most helpful, it was possible to visit more museums than he had hoped, and there proved to be more specimens than he had dared to expect. The data now being plotted reveal significant differences between the eleven species of beaked whales, and it will soon be possible, for the first time, for zoologists to identify with confidence new specimens of this difficult genus.

LOOK A NEW WHALE SPECIES IN THE FACE!

This is the skull of the type specimen of a new whale, Mesoplodon carlhubbsi, *just recently distinguished and described by CNHM's Curator of Mammals. So far it is known with certainty only from six specimens, one each from La Jolla, Drakes Bay, San Simeon Bay, and San Francisco Bay, California; from Oyhut, Washington; and from Ayukawa, Japan.*

In the photograph the skull is facing you. The two teeth stand up, tusk-like, from the lower jaw. Between them is the long beak extending straight toward you. Above the beak is a large double hole opening upward: it is the blow-hole through which a whale breathes out of the top of its head. The eyes would be located at the outermost extent of the bone on each side of the head.

Dr. Moore calls this whale the "arch-beaked whale" to distinguish it from other species of the beaked whale family Ziphiidae. *The five adult males studied have teeth like this; the teeth of one immature female did not protrude above the gum.*

STAFF ACTIVITIES

AT A SYMPOSIUM held during recent meetings of the Central States Anthropological Society, Dr. Donald Collier and Mr. George I. Quimby, Curators in the Department of Anthropology, discussed the role of the museum in communicating anthropological concepts to the general public. Mr. Phillip H. Lewis, Curator of Primitive Art in the Department, described a very rare sculptured figure from New Ireland, which is in the Museum's collections.

A paper on wooden trade objects of the Upper Great Lakes was also presented by Quimby at a symposium on historic archaeology held during meetings of the Society for American Archaeology.

IN AUGUST, the Tenth International Botanical Congress is to be held in Edinburgh, Scotland. Congresses are usually held each four years, permitting botanists to get together to discuss problems, research, and progress. The systematists meet during the Congress period to discuss and legislate the international rules that regulate and make uniform the nomenclature of plants. In these sessions, Dr. Louis O. Williams, Chief Curator of Botany, will represent the Museum, the University of Wyoming, Escuela Agrícola Panamericana, Museo Nacional de Costa Rica, and Museo de Historia Natural "Javier Prado" of Lima, Peru. Dr. Williams plans to visit the Conservatoire et Jardin Botaniques in Geneva and Instituto Antonio José Cavanilles in Madrid before the Congress opens.

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Bulletin

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Water Birds

OF NORTHERN VACATIONLANDS

Melvin A. Traylor, Jr.
Associate Curator, Birds

Cover and below: Habitat exhibit of blue herons and wood ducks.

AUGUST is the month when the minds of most city dwellers turn to dreams of the north woods, away from the dirt and grime of the city. Many will make their dreams a reality by going off into the cool forests and lakes of our northern states, but for those of us not so privileged, the Museum's exhibits-of-the-month may offer some solace in the heat of summer.

Located in Hall 20, the twin exhibits of northern Michigan recreate the shore line of one of the many clear-water lakes that dot this area. Somnolent on an August afternoon, with the dust of a dry summer heavy on the foliage, the scene reproduced on this page and the cover is typical of those that greet the fisherman as he drifts along the lake. Here are a pair of blue herons fishing along the water's edge. Their stately look and deliberate actions are belied by the noisy activity to be found in the rookery in the painted background. The little green heron, feeding its two young on the nest, is never an obtrusive bird and is seldom noticed until it flushes from a low bush with a quiet croak and flies along the shore line to land and melt into the background farther down.

Half hidden by the overhanging brush is a pair of wood ducks, probably our most striking native bird. As you study the brilliant plumage of the drake, you might think that he would be obvious anywhere, yet he is strangely elusive as he works his way along the water's edge and is seldom seen before he flies. Forty years ago the wood duck was nearing extinction, but protection from hunters and the provision of nesting boxes to supplement the hollow trees where it normally nests have enabled it to recover, and it is common now even in our local forest preserves.

As you paddle around the next point (to the adjoining exhibit case) a pair of loons first attracts your attention. Probably no bird so well typifies our northern lakes as the loon. In the wilderness areas every lake will have a pair or more, apparently undisturbed by the visitors but actually staying well out of range, diving and coming up at unexpected spots whenever approached closely. But it is at night that the loon really makes its presence heard; its eerie call echoing across the lake is an unforgettable symbol of the northern wilderness. Unfortunately the loons are not so tolerant of man and his works as the herons are, and as the roads and resorts extend farther each year, the loon makes a steady retreat northward.

Beyond the log behind the loon is a hooded merganser, another strikingly marked duck that is frequently overlooked. Although it lacks the flashing reds and greens of the wood duck, its more sombre black, white, and rufous colors make a handsome pattern. It also is a tree-nesting duck, and in the background the female may be seen about to leave her nest hole.

While summer in Chicago cannot compete with the north woods, we hope that our August exhibits will at least evoke fond memories for those who have known the pleasures of our northern lakes. END

INNER SPACE

THE MUSEUM EXPANDS

This area, 208 feet long by 38 feet wide by about 31 feet high, is currently being enclosed. The new construction will provide expansion for the Museum Library and increased facilities for storage, research, and graduate education in the Department of Geology.

James R. Shouba
Building Superintendent

About half a century ago, a gifted group of architects, Graham, Anderson, Probst, and White, was commissioned by Mr. Stanley Field, then President of Chicago Natural History Museum, to design and build a new, spacious, fire-safe building to house the Museum's collections and exhibits. By 1920, this building was complete enough for the staff to move in.

We can easily imagine that upon first viewing the vast, empty, echoing caverns of the new structure the staff probably thought they would never need more space. In fact, I believe they were thinking, "How shall we ever fill it?" Generous aisles, work rooms, offices, and collection storage areas were allocated, as well as large exhibition halls.

Because of the grand scale of the Museum building, we still tend to retain, after 50 years, this train of thought. But with the continued growth of specimen collections in all divisions of the Museum, we have been giving more careful consideration to the use of our remaining available space.

When suddenly there came the opportunity to increase our usefulness by acquiring the University of Chicago's famous Walker Collection of fossil invertebrates, we had to face up to hard facts. Where could we possibly house such a tremendous collection?

Perhaps the architect purposely left great open spaces between the masonry of our second and third floors. Perhaps he planned the large light wells so that we could quite easily expand in 1964 without changing a single detail of the building's classical exterior. At any rate the solution that was worked out was so easily adaptable to the architect's design that it seems as though it must have been planned in 1913–15. We decided to fill in a light well in the northwest corner of the Museum building.

In considering this solution, the first question we needed to answer was whether the space was large enough to house the more than a million specimens in the Walker Collection and provide for normal expansion of the Department of Geology for at least the next 25 years. A preliminary layout for geology storage cases was drafted to get a rough idea of the capacity of the light well. These studies indicated that the capacity was more than the estimated area required, so we proceeded with further investigation. Expansion of the book stack area of the Library was next considered and the decision made to place the stack room on the third floor level immediately adjacent to the pres-

(*Continued on page 8*)

CHICAGO NATURAL HISTORY MUSEUM

Museum News

New Student Seminars

On JULY 8, Chicago Natural History Museum inaugurated a new summer enrichment program for selected students from Chicago high schools.

More than 150 students from 33 schools have signed up for the summer program, which is divided into three series, on anthropology, biology, and the earth sciences. Each series is designed (1) to impart basic knowledge of the subject, (2) to provide a glimpse of the scientific research done in a large museum, and (3) to suggest some of the career opportunities available in museum work.

Laboratory workshops, discussions, tours, individual projects, and motion pictures are planned for each series. In the sessions on earth science, students will learn about the anatomy of the earth and the geological processes that have molded our planet. In the biological series, they will discover how plants and animals developed and live today in relation to each other and to their natural environments. The anthropology series will feature workshops on prehistoric man and the Indians that lived in the Chicago area. Some of these sessions will be held in the Pacific Research Laboratory, where students will be introduced to collections from many cultures around the world.

During the summer informal meetings are planned with Museum scientists, who will discuss their research-in-progress. Museum technicians will also participate by demonstrating their work in making the life-like models of plants and animals for which the Museum exhibits are renowned. The installation, now under way, of the new Hall of Useful Plants, will give students an opportunity to observe some of the many skills demanded in behind-the-scenes phases of Museum work.

The summer seminars have been developed by the Raymond Foundation, the Museum's educational division, in consultation with the curriculum department of the Chicago Board of Education. According to Miss Miriam Wood, head of the Raymond Foundation, "The need for educational and cultural enrichment programs for our young people has long been recognized by students, teachers, and parents. The Museum is very pleased to make its resources available to high school students this summer, both to increase their knowledge of the natural sciences and to show them the abundance of educational and scientific materials which the Museum possesses. By showing students how to make use of these resources in their everyday lives, we hope to open up new vistas for them and point the way to future careers."

Report on Nepal Birds

A SCIENTIFIC report of the Museum's part in the 1960–61 World Book Encyclopedia Expedition to the Himalayas has just been published by the Museum Press. The purpose of this expedition was three-fold. Under the direction of Sir Edmund Hillary, the major effort was devoted to an evaluation of the effect of altitude on the human body. This study was made by a group of medical men during a winter spent in a hut on Makalu, the world's fourth highest mountain, at an altitude of 20,000 feet.

A second goal of the expedition was an attempt to prove or disprove the existence of the yeti. At least part of this question was resolved when Mr. Philip Hershkovitz, Research Curator in the Division of Mammals, identified a so-called yeti scalp as an ancient artifact fashioned from the hide of a serow.

The third purpose of the expedition was to obtain a scientific collection of Nepalese birds and small mammals. A grant to Chicago Natural History Museum from World Book Encyclopedia made it possible for Dr. Robert L. Fleming, Field Associate in Zoology, to undertake this work. Dr. Fleming is a missionary in Nepal as well as a noted amateur ornithologist who has made and reported on several important collections for the Museum.

In *Further Notes on Nepal Birds* (Fieldiana: Zoology, Vol. 35, No. 9), Dr. Fleming provides a fascinating account of his part in the Himalayan expedition. In various regions of Nepal, from forested valleys to mountain heights above 11,000 feet, Fleming obtained 42 species of birds that are new to his collections. Of these, five species and two subspecies are recorded for the first time from Nepal. The current publication also includes Fleming's field notes on a total of 75 species. Melvin A. Traylor, Associate Curator of Birds, has supplied identifications and taxonomic discussions for the systematic list.

For readers who may have the opportunity to travel or collect in Nepal, Fleming provides an appendix outlining

the governmental requirements, conditions to be expected, equipment needed, and other useful information based on his extensive experience in that country.

Weeds

AN EXHIBIT of more than 40 water colors by Mary Virginia Roberts, a San Francisco artist who specializes in the painting of weeds, is on display at the Museum through September.

John Millar, the Museum's Curator Emeritus of Botany, has selected the paintings for the new exhibit. According to Mr. Millar: "Weeds are generally regarded as obnoxious intruders into the sacred precincts of our gardens and fields. Gardeners know, however, that these unwanted plants possess admirable qualities of hardihood, persistence, and even beauty—as dandelions and many others demonstrate. Miss Roberts has succeeded well in revealing the attractive colors, structure, and stages of growth of a number of ubiquitous weeds. Her unusual choice of subject is matched by the Museum's unusual hanging of the show, which we think that gardeners, especially, will enjoy."

Left: Artichoke thistle

Far left: Cat-tails

New Food Management

THE Museum cafeteria and lunch room are now under the management of Szabo Food Service, Inc., a national food service company operating in 24 states. The new management has put a number of procedures into operation to ensure high standards of efficiency and quality.

On Wednesday, Friday, Saturday, and Sunday—nights of the free Grant Park concerts—the cafeteria is open from 11 A.M.–7:30 P.M., serving both luncheon and dinner. On other days the cafeteria closes at 2 P.M. Snacks and light lunches are available in the lunch room daily from 11 A.M.–3 P.M.

Staff Activities

LAST MONTH, Dr. Edward J. Olsen, Curator of Mineralogy, spent three weeks in the field in northern Wisconsin, northern Minnesota, and a small portion of southern Ontario. Dr. Olsen is studying the mineral compositions in meteorites. His purpose on this field trip was to collect specimens from the Duluth gabbro, a large igneous body containing the minerals olivine and pyroxene. Since the compositions of these two minerals depend strongly on the temperature of crystallization, their analysis yields temperature values which may be compared directly to very similar compositions in many stony meteorites.

In northern Minnesota, Dr. Olsen found a new road construction which afforded him the opportunity to collect freshly blasted, and therefore relatively unweathered, gabbro specimens. He also obtained good collections from the basal part of the gabbro. The olivine and pyroxene minerals in his specimens are currently being separated for analysis.

A GRANT of $5,000 has been awarded the Museum by the National Science Foundation for continued support of research leading to a catalog of all living mammals of South America. Conducting the project is Mr. Philip Hershkovitz, Research Curator in the Division of Mammals. Mr. Hershkovitz recently presented a paper on the taxonomy and geographical distribution of marmosets, and led the ensuing discussion, at a round table conference on marmosets held at the University of Texas in Houston.

THE BOOK, *Birds in Summer*, by Dr. Austin L. Rand, Chief Curator of Zoology, has been translated into French for distribution in France. *Birds in Summer* is published by Encyclopaedia Britannica Press.

(*Continued on next page*)

(*Continued from preceding page*)

DR. G. ALAN SOLEM, Curator of Lower Invertebrates, and Dr. Fritz Haas, Curator Emeritus, attended meetings of the American Malacological Union held last month at Asilomar, California. Dr. Solem presented two papers at the meetings, one on two genera of neotropical land snails and the other an account of his collecting in different parts of the world.

WORD has been received that Dr. Georg Haas, Museum Field Associate in Zoology and Professor at the Hebrew University in Jerusalem, has received the Rothschild prize of 8,000 Israeli pounds for his internationally acclaimed work in the systematic zoology, paleontology, and prehistory of Israel.

DR. SIDNEY F. GLASSMAN, Research Associate in the Department of Botany, represented the Museum at a conference on "The Herbarium in the Modern University" held last month at Michigan State University.

George Langford 1876-1964

GEORGE LANGFORD had an uncommon number of strings to his bow. He could have been—and was—an engineer, an athlete, an illustrator and sculptor, a fossil collector, genealogist, historian, poet, and archaeologist. Thus, when he retired in 1946 as president of a steel processing company, he was able to shift, at the age of seventy-one, to one of his other careers. After a brief vacation, he came to Chicago Natural History Museum, where he occupied the post of Curator of Fossil Plants from 1950 to his retirement in December, 1961.

Born May 26, 1876, in Denver, Mr. Langford lived there for nine years, enjoying a largely out-of-door existence, honing his curiosity regarding all aspects of nature. Then, his father having died, he lived with his grandfather Robertson

(*Continued on page 8*)

A RARE Fossil Jell

EUGENE S. RICHARDSON, JR.
Curator, Fossil Invertebrates

HEN'S TEETH and similar rarities, when examples of them come to hand, are always worthy of comment. The specimen illustrated here is such an item. It is a slab of hard, pink-stained quartzite about a foot across, its surface tinted red with iron oxides so that it resembles a piece of rare meat. It bears numerous circular impressions, the largest about two inches in diameter. These, coupled with the geologic relations of the quartzite in the Ediacara Hills of South Australia, give this specimen a more than ordinary interest.

The little round impressions are interpreted as fossil evidence of small jellyfish washed up on a beach some six hundred million years ago. Because of their delicate construction and lack of hard skeletal parts, jellyfish are not commonly preserved as fossils. Nevertheless, they are occasionally found, and about twenty-four distinct kinds are known.

How is it that such an ephemeral and —yes, let's admit it—jellylike object can make any kind of impression in the sand of a beach? Luckily, the process has actually been observed. On death, the flabby body washed up on the shore loses moisture and becomes sticky. Not only do sand grains adhere to the withering remains, but some of the organic matter soaks into the sand beneath. If now a wind blows more sand across the site, the "blob" is buried and pressed into the former beach surface. Millenia later, mineral solutions will have penetrated the sand. The old beach surface will now be a bedding plane in an otherwise hard sandstone, with the dimple left by the former medusa still visible on it. Such was probably the history of these specimens.

Aside from the rarity of fossil jellyfish as such, the age of these in particular and of the rock in which they occur has been a matter of interest, for they are among the oldest of all known fossils. In 1947, Mr. R. C. Sprigg discovered impressions of soft-bodied animals near the top of the Pound quartzite about 380 miles north of Adelaide, Australia. He published a paper that same year, in the *Transactions of the Royal Society of South Australia*, describing the fossils and their occurrence. Two years later, after further field work, he described additional fossils of soft-bodied animals from the same place, including the first specimens of what is now known as *Spriggia annulata*.

In these first papers on the Ediacara fossils Sprigg referred to them as Early

yfish

Like heel-marks in a velvet carpet, impressions of delicate extinct jellyfish dot the surface of this piece of ancient quartzite (silicified sandstone) from the Ediacara Fossil Preserve in South Australia. The undulating surface of the rock reveals the ripple-forming action of gentle waves lapping upon a Cambrian beach.

Cambrian in age. That means that these animals lived at the beginning of the first of the geologic periods whose rocks enclose more than the merest traces of the presence of life on earth. Such hoary antiquity in itself gave these fossils an added importance.

But more was to come. As continued field work built up the collections from the Ediacara Hills, geologists reviewed the evidence for assigning an Early Cambrian age to the fossils. Beneath the jellyfish-bearing bed are nearly two thousand feet of Pound quartzite with no fossils aside from a few worm burrows down near the base; above it, this formation continues for a hundred feet with no fossils, and is followed by about 450 feet of barren Ajax limestone before the next fossil-bearing layers are encountered. Those higher fossils, however, are brachiopods and spongelike archaeocyathids similar to fossils recognized elsewhere as being earliest Cambrian in age. Therefore, some of the investigators reasoned, *Spriggia* and its associates must be even older than supposed, and thus of pre-Cambrian age. Now throughout the world there are a few occurrences of pre-Cambrian fossils, but they reveal very little of the life of those times. If the Ediacara fossils are indeed pre-Cambrian, they are incomparably the best fossils from that ancient time. At present, however, some geologists date the deposit as Early Cambrian, while others date it as pre-Cambrian.

In May 1958, Sprigg's original locality and a patch of the surrounding country were set aside as the Ediacara Fossil Reserve, under the control of the Australian Minister of Education and of the South Australian Museum. With the cooperation of these authorities, the specimen discussed here was secured last year by a Chicago business man, Mr. Victor D. Oakley, while visiting in Australia, and was recently presented by him to the Museum. Following the usage of both the American (1956) and Russian (1962) *Treatises* on fossil invertebrates, we have catalogued the specimen as Cambrian.

Museum News

Chicago Natural History Museum
Founded by Marshall Field, 1893
Roosevelt Road and Lake Shore Drive
Chicago, Illinois 60605
Telephone: 922-9410

(*Continued from page 6*)

in St. Paul, alternately poring over that gentleman's extensive botanical library and exploring the still wild country of Minnesota with his school friends. As a member of the class of 1897 at Yale's Sheffield Scientific School, Langford studied engineering and participated in crew racing, including the 1896 race against Oxford.

Upon graduation from Yale, Langford was employed as millhand and draftsman by the McKenna Process Company in Milwaukee, and shortly was in charge of building new plants for the expanding firm. With his bride, the former Sydne Holmes, he settled in Joliet, Illinois, in 1900, near one of these plants. The loss of his left arm in a mill accident did not hinder him from continuing his avocation of research in natural history. As his collections grew, his house became crowded with Indian skeletons and artifacts, fossil plants, and even fossil elephants.

Upon his retirement from business, these collections were sent to universities and museums, and the Langfords moved to Chicago. Here Langford continued his collecting, but now for the Museum. During the years of his Museum appointment he continued to visit his favorite localities in the northern Illinois strip mines, and made nine strenuous collecting trips to Tennessee for Mesozoic and Tertiary plant fossils. His advice on classification of Coal-Age plants from the strip mines was continually sought by the large community of Chicago area collectors. He remained actively interested in his collections until his death on June 16, 1964.

Among Langford's publications are two volumes of notes on Coal-Age plants, four novels for children on prehistoric subjects, several articles on metallurgy and steel technology, some verse, and articles on his Indian mound excavations. (*E. S. Richardson, Jr.*)

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Members are requested to inform the Museum promptly of changes of address.

INNER SPACE

(*Continued from page 3*)

ent reading room. The major portion of the geology collection would be housed on the second floor level and a mezzanine.

The magnitude of the floor loads was the next thing to determine, to see whether the building's original pilings and piers could bear the added weight. Structural engineers investigated and determined that the substructure was able to sustain the estimated loads with a comfortable margin of safety. Thus all elements seemed to be present for a logical solution to the problem of housing the Walker Collection and providing space for the normal growth of all geology collections.

In addition to fulfilling these requirements, we will be able to create office and work rooms for each geology curator within the new area, and allocate space for future staff appointments.

The Library will receive a 56 per cent expansion in stack space, plus new offices. Also, by shifting the present offices of Museum artists and editors to areas vacated by the geology department, space will become available to expand the overcrowded Division of Insects. An increase of 2,400 insect storage drawers will be provided to serve the Division's most pressing needs.

THE FIRM of Olsen and Urbain, Architectural Engineers, was commissioned to develop our sketches, determine a logical construction system, and prepare preliminary budget figures.

The Museum then applied to the National Science Foundation for a grant to cover costs of building, remodeling, and equipping the areas involved. After the Foundation's advisors completed an investigation and evaluation of the entire Museum program, a grant of $875,000 was approved.

Detailed working drawings and specifications were drawn up and sent out for bids on March 27, 1964. The successful low bidder was the B. W. Handler Company. Contracts were signed, steel work is being fabricated, and on June 1 actual work was begun.

IT is estimated that 200 calendar days will be required to complete the structural portion of our project. About next January, if all goes well, we should be transferring geological specimens to new quarters in the "filled in" light well.

PRINTED BY CHICAGO NATURAL HISTORY MUSEUM PRESS

CHICAGO NATURAL HISTORY MUSEUM

Bulletin

Vol. 35 No. 9

September 1964

CHICAGO NATURAL HISTORY MUSEUM

MUSEUM NEWS

Mary Virginia Roberts was not frightened away by the spider, but stayed on to finish her delightful paintings of weeds. A display of her work is on exhibit in Hall 9 through September.

This Month's Cover

RECENT VISITORS to the Museum were startled to see a steely skeleton, 160 feet high, looming over the Museum building. For a moment, a prehistoric monster seemed to be storming the walls.

But on second glance the monster was revealed as a huge crane, being used to erect the framework for the new addition to the Museum. As Members know, a light well between two wings of the building is being filled in to provide expansion for the Department of Geology and the Library.

The crane is the largest type made: it boasts 160 feet of boom and an additional 50 feet of jib, and has a lifting capacity equal to its weight of 60 tons. It is approximately twice the size and weight of a real prehistoric monster, Brontosaurus, who lived 150 to 175 million years ago and is the largest land animal ever known. The Brontosaurus displayed in the Museum is 72 feet from head to tail —a distance so great that the species actually needed two nerve control centers, or brains, to coordinate its movements. One brain was in the usual place inside the giant reptile's skull; the second was farther down the spine toward the rear. The construction crane, also, has two control centers: one in the crane operator's cab, the other an electronic "walkie talkie," 175 feet away, over the Museum walls. Working together but out of sight of each other, the operators of the two control centers "direct" the crane to pick up 3300-pound steel joists, lift them high over the Museum roof, and set them down with delicate precision within the light well.

Watching the crane in operation, we got to wondering. If it *were* a monster, what would happen if one of the Museum's dinosaurs (say a belligerent Gorgosaurus) got wind of the intruder, stepped down from its display pedestal, and went outside to investigate? This month's cover, by the Museum's Division of Photography, pictures our fantasy. The montage is by Ferdinand Huysmans.

New Fall Journey

HOW TOWERING plants, on which brontosaurs and other dinosaurs fed, developed from simple algae is seen in Chicago Natural History Museum's new fall Journey, "A Billion Years of Plant Life." The Journey begins September 1 and continues through November.

The trek through time starts with the examination of a fossil which scientists believe may be over a billion years old. Its imprint shows one of the earliest plant forms known—simple aquatic algae. Other fossils and displays illustrate the gradual yet dramatic changes in plant life that have taken place since these primitive organisms: the appearance of land plants, the development of forests, and the emergence of flowering plants.

Highlight of the Journey is a full-scale reproduction of a Coal-Age swamp forest, crowded with giant ferns, scale trees, and the 20-foot scouring rushes that have evolved into our present-day, 12-inch horsetail plants.

Children wishing to take the fall Journey may obtain directions and a questionnaire on entering the Museum. Using the exhibits to find answers, youngsters complete and turn in the questionnaires to receive credit in the Museum's Journey Award Program.

Moon Shots Displayed

PHOTOGRAPHS taken by Ranger 7 on its successful flight to the moon are now on display in Stanley Field Hall.

Of the 4,316 pictures transmitted by the spacecraft, 17 are shown from the final series taken before impact. Five pictures have been especially enlarged for the exhibit.

These remarkable photographs show the lunar surface as it appears at altitudes from 480 miles to 1,000 feet. Transmission of the final picture was interrupted when the spacecraft hit the moon. The resolution seen in this picture is a thousand times better than can be obtained from Earth-based observations.

A diagrammatic outline of Ranger 7's

(*Continued on page 8*)

g. 1: "Shell-and-bone" ript, late 2nd millennium C.

Fig. 2: Inscription on ceremonial bronze ax, late 2nd millennium B.C.

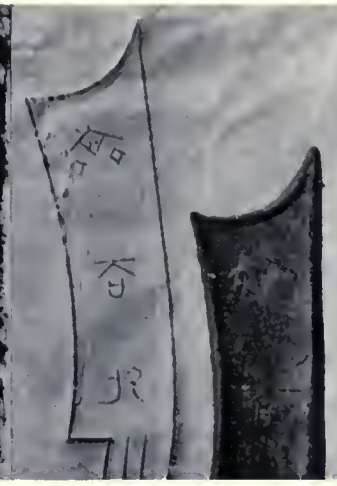


Fig. 3: Inscription from a bronze "knife coin" from the State of Ch'i, 1st millennium B.C.

Fig. 4 (above): "Seal style" inscription on a roof tile, late 1st millennium B.C.

Fig. 5: Reign name in "clerical style," from tomb brick, dated A.D. 96.

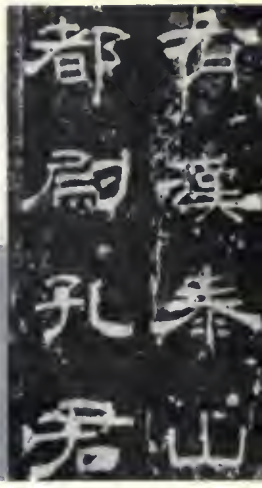


Fig. 6: Portion of inscription in "clerical style" on a rare rubbing of a memorial stone erected to K'ung Chou, lineal descendant of Confucius, dated A.D. 164.

CAT DOG BOY GIRL

上 大 人

M. Kenneth Starr, Curator

Asiatic Archaeology and Ethnology

MANY American children learn to recite their ABC's by means of the following familiar jingle:

ABCD, EFG	Now I know
HIJK, LMNOP	My ABC's,
QRS, TUV	Tell me what
W, and XYZ	You think of me.

Having mastered the recitation of the alphabet, the youngsters then learn to write the letters, upper case and lower, first in block form and then in cursive form. Next, the individual letters are put together to form simple words such as *cat* and *dog*, and, finally, the words are strung together to make sentences. Through the years the student gradually learns longer and more difficult words such as *pneumonia*, *chalcedony* and *antidisestablishmentarianism* and with these expresses more complex ideas. In this continuing educational process both science and memory play their part: there are principles for forming the letters and for combining them into words. Thus, *c-a-t* becomes *cat* and in this particular sequence symbolizes a feline animal, while *d-o-g* becomes *dog* and calls to mind a different image. Memory, too, is of no small importance, as will be allowed by those of us who still rely on "*i* before *e*, except after *c*."

Chinese and English

Chinese children, too, must rely upon both science and memory in learning to write, but in both the actual writing and in the building of vocabulary memory plays a more important role in learning Chinese than it does in learning to write English. This situation in large measure arises from the fact that the principles on which the writing of the two languages is based are very different.

English and Chinese belong to two completely unrelated language families, and, more importantly for present purposes, the writing of the two languages is founded upon totally different concepts. The writing of English, and of Western languages generally, is based upon an alphabet composed of letters, twenty-six in the case of English, that represent the corpus of sounds occurring in the spoken language.[1]

Written Chinese, however, is non-alphabetic and so has no letters that can represent the sounds of the spoken language and spell "words" as we know them. Instead, Chinese is based upon the representation of things and ideas by means of "characters"—pictograms, ideograms, and phonograms whose traceable origins in China go back at least to the middle of the second millenium B.C.

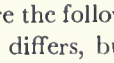
(*Continued on next page*)

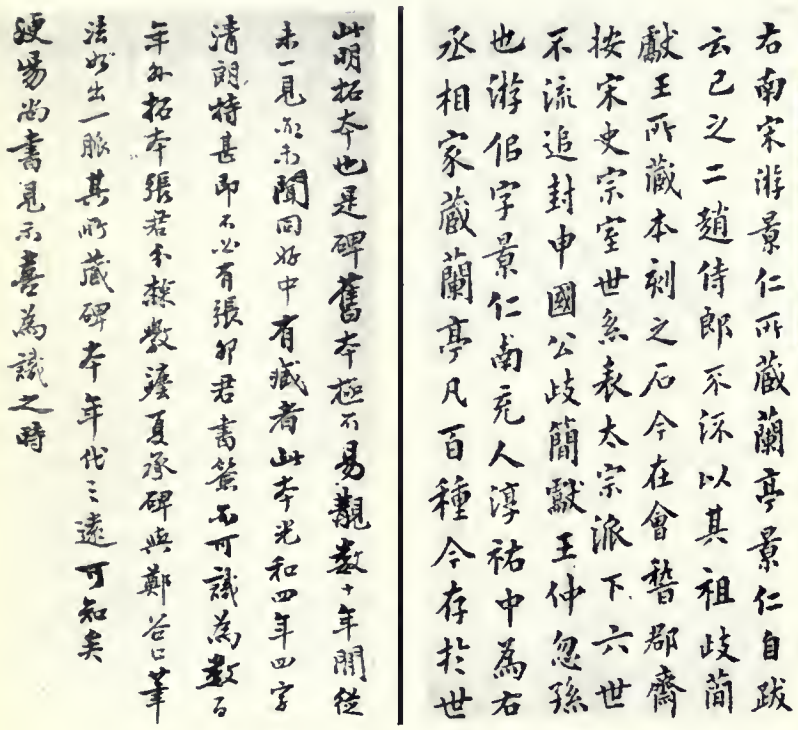
[1] This representation more often than not is both clumsy and inaccurate, thus contributing to problems in spelling. In English, there have been efforts to ameliorate this situation by modifying the alphabet so as to make it conform more closely to the corpus of sounds in the spoken language. The 44-letter Initial Alphabet of Sir James Pitman, which has gained increasing acceptance in England, is an example of such an effort.

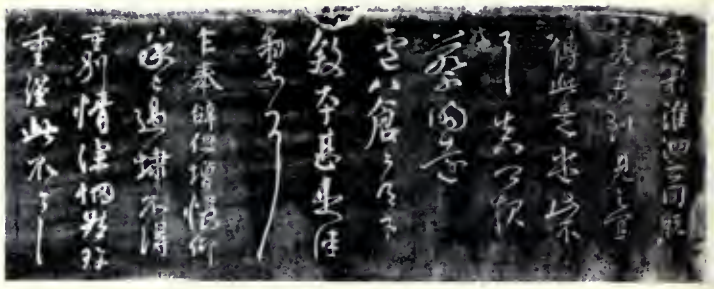
Simply described, without reference to origins and evolution, pictograms represent things, as 日 (*jih*) for *sun* or 月 (*yüeh*) for *moon;* and ideograms represent ideas, as 明 (*ming*), in which *sun* and *moon* are combined to express the idea *bright*. Phonograms, which compose the great majority of Chinese characters, are compound forms, made up of two parts, a meaningful element and a phonetic, or sound-indicating element. Exemplary of phonograms are the following characters, in which the meaningful element differs, but in which the phonetic element is the same. Thus, save for tone (*i.e.*, the pitch associated with spoken Chinese words) the following characters all are pronounced *tsu:* 俎 (dish for meat), 徂 (go), 殂 (die), 祖 (ancestor), 租 (rent), 組 (group, organize), 詛 (curse), 阻 (hinder), 齟 (gnaw), 菹 (pickles). This combination of meaningful and phonetic elements very roughly may be compared to an English-language situation in which the several different meanings of *hot* would be written in the following manner: *hot* (fire-hot), *hot* (pepper-hot), *hot* (jazz-hot).

In Chinese, as in English, both science and memory serve as teachers. Science is to be found in the definite principles governing the way in which characters are *built*, by combining meaningful and phonetic elements, and *written*, by using the proper number and order of strokes. Memory also plays its part in these areas and, more particularly, in enlarging the stock of characters necessary for sophisticated communication.

Form and esthetics

Although the experience lies on the limen of remembrance, most of us either recall learning to write or have relived the learning situation through our children. Most simply described, the process includes mastering the *forms* of letters and their combination in words, and the *esthetics* of writing them. This latter need is more or less happily satisfied by learning to sit and hold the pen properly, by scribing yards of circles  on lined paper to gain control and fluidity, and by imitating perfectly written, though characterless, models penned in a handwriting manual.





Far left: Colophon inscription in "rapid style" by Wang Kuan, dated A.D. 1907.

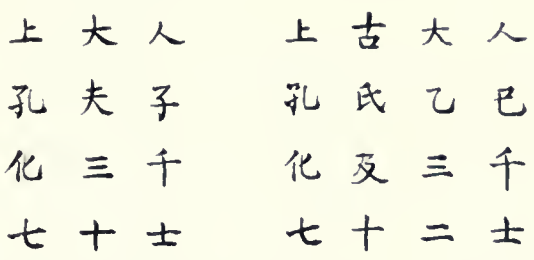
Left: Portion of a colophon inscription in the "regular style" by Weng Fang-kang, dated A.D. 1791.

Above: Calligraphic model (fa-t'ieh) of the "grass style" of Yen Chen-ch'ing (T'ang period, A.D. 618-907).

Despite the differences between English and Chinese, much the same teaching pattern has been followed in China. Forms must be learned, largely by rote at the beginning, and esthetics must be satisfied. As in our own system, this process begins in what is called "small school," comparable to our grade school, and continues into "middle school," comparable to our junior and senior high schools. Tots are given what are known as *hung tzu pu*, or "red character models"—sheets of paper on which simple characters are printed in red. Transparent paper is laid atop these models, and the student then traces the underlying characters with Chinese brush-pen and ink. Later, the student dispenses with the *hung tzu pu* and strikes out on his own, imitating calligraphic models set before him. In these initial stages, as in writing English, the teacher at first guides the learner's hand and then, as the student gains confidence and control, allows him to write by himself.

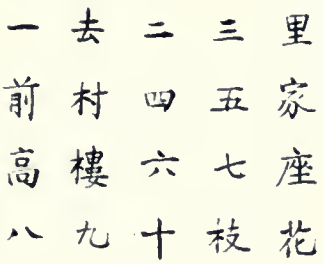
The student begins with characters that are simple in

both form and meaning. As *cat* and *dog* are used in English, similarly certain characters in Chinese traditionally are used for the beginning writer. Some of these are presented singly, as the character 永 (*yung*, "eternal"), which includes the basic types of brush strokes 丶 亅 ノ 丿 乀 . Often, a number of simple characters are grouped mnemonically, as shown below, where there are two such sets, the second a longer variant of the first.



Broadly translated, these two sets explain that the great man Confucius taught 3,000 (students), among whom there were some seventy scholars. Such a simple set serves two purposes: one, to teach the writing of elementary characters and, two, to inculcate a socially valued concept, in this case the Confucian ethic traditionally followed by the Chinese for more than two thousand years.

Other sets, as the following one, include more complex characters, also arranged mnemonically:



"*One* (person) went *two* or *three* miles;
Ahead was a village of *four* or *five* houses,
A high building of *six* or *seven* stories,
And *eight*, *nine*, or *ten* branches of blossoms."

Once the initial learning process is over in the early grades, the rest, as with learning any language, is a matter of increasing the vocabulary and improving the esthetic quality of the brushmanship. Here exists one of the major differences between written Chinese and written English: written Chinese still is considered an art, as well as merely a means of communication. In old China, calligraphy was both a medium of communication and a fine art, equal or superior to painting. Scholars devoted years of practice, sometimes many hours a day, to the writing of the character in one or another of the styles that marked Chinese writing in the course of its development.

Organized in two groups, archaic and modern, the major styles are illustrated in Figs. 1–6, and in the exhibit on calligraphy in the Museum's new Chinese gallery. Among the archaic styles there are (1) the so-called "shell-and-bone script," the earliest known form of Chinese writing, current during the latter part of the second millennium B.C.; and similar forms found on other materials, notably ancient bronzes; (2) the several forms of the "seal style" used in the course of the first millennium B.C.; and (3) the strong "clerical style" characteristic of the Ch'in and Han periods, roughly contemporaneous with the Roman Empire. To these are added the three major styles in common use since the 4th century A.D.: (4) the "rapid style," (5) the "regular style" and (6) the "grass style." It was these major styles, as well as an infinite variety of intermediate and eccentric variants, that were copied and elaborated upon for many hundreds of years, with the variations subject only to the limitations of the creative powers and technical skills of the scholars and artists who conceived them.

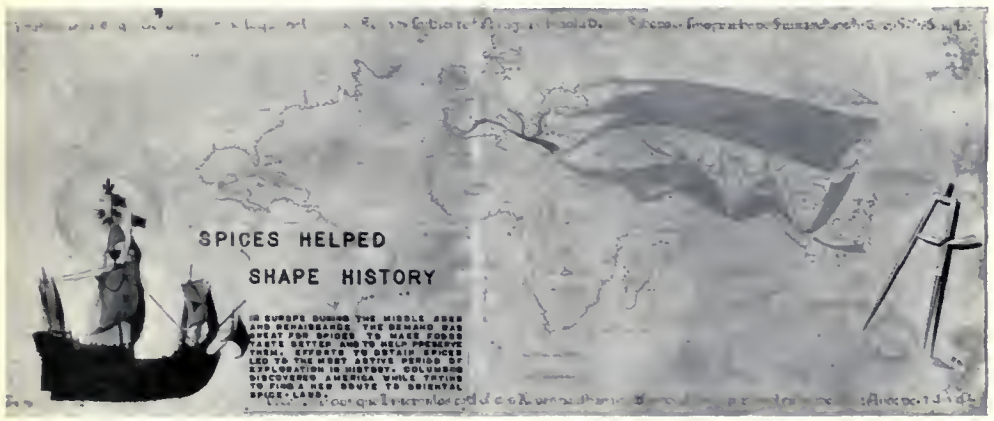
In striving for artistry in the writing of their language Chinese students imitated the brushmanship of famous calligraphers of former times. By reason of the long centuries of interest in calligraphy in their civilization, Chinese students could draw upon a wide, wide range of styles represented in models of the hand of one or another of hundreds of eminent calligraphers. Such calligraphic models, or *fa-t'ieh*, still are very common and can be purchased in Chinese stationery shops. The Museum has an extensive collection of *fa-t'ieh*, one of which is represented here by the "grass writing" of Yen Chen-ching. In recent decades two variants of the "regular style," the most common form used today, have been commonly imitated by students: a "thin" variant in the hand of Liu Kung-ch'üan and a "fat" variant in the hand of Yen Chen-ch'ing, both calligraphers of the T'ang period (A.D. 618–907). As has been described, however, the more serious or gifted students might choose one or another of many other styles more pleasing to their esthetic sense or personality.

The end of old ways

In the West the necessity for learning form continues, but the interest in good penmanship has declined steadily, until now it is all but nonexistent. Once, when the typewriter was new, one apologized for typing rather than writing by hand; now, one apologizes for not using the typewriter. In our society the last refuge of handwriting is its continued use in the writing of social letters—invitations, bread-and-butter notes, and the like—and even in this area penmanship is losing ground. In China, too, a similar trend is apparent. There is a general decline of interest in calligraphy, a decrease in time devoted to the practice of calligraphy in school, a less frequent use of the writing-brush, and a correspondingly greater use of fountain pen and ball-point. Underlying all these changes, the speed of modern life has taken its toll of Chinese calligraphy, with the result that fewer and fewer Chinese either produce or appreciate the fine writing that for so many hundreds of years in China was the mark of the learned and cultivated man. ■

FALL WORKSHOPS for Children of Members

SATURDAY workshops in the Museum sciences, a series of programs inaugurated last fall for the children and grandchildren of Members, will again be offered in October.



From the October 24 workshop on "Spices: Trail-Blazers to New Lands."

The workshops are designed to stimulate and develop interest in the study of nature and mankind. They provide youngsters with a unique opportunity (1) to meet with Museum staff members and explore the natural sciences and anthropology; and (2) to work with Museum specimens and materials, both in the exhibits and from the study collections.

This year, the workshops are divided into two sections for different age groups. For boys and girls aged 10 through 13, six programs, each lasting about an hour and a half, are offered; for younger children aged 6 through 9 there will be two one-hour workshops. To insure individual attention and participation, each session is limited to a small group. Reservations are necessary and will be accepted in the order in which they are received. An application form is enclosed with your BULLETIN. Each applicant will receive a confirmation card which will serve as the admission card. Last year it was not possible to accommodate all applicants; we therefore urge that reservations be sent in early.

Following is a complete schedule of dates, hours, and workshop subjects:

OCTOBER 3

"Indians of the Woodlands and Plains"

10:30 A.M., repeated at 1:30 P.M.
for ages 10 through 13

Harriet Smith in charge

In different regions, Indian tribes developed a life that fitted their kind of country by using materials furnished by nature. In this workshop, youngsters will handle these raw materials and see for themselves how their qualities were utilized in making actual Indian tools and equipment. Movies, showing how tribes of the Woodlands and Western Plains were living when the settlers came, give a basis for discussions comparing different Indian ways of life.

"Insects"

10:30 A.M. only
for ages 6 through 9

Maryl Andre in charge

Insects are the easiest animals to collect, and October is still early enough to start your own collection if you know where to look for them. In this workshop youngsters will learn about the great variety of insects and where to find them. They will also study the parts of the insect body and how they are used. Taped sounds of insects of the Chicago region will help boys and girls to recognize insect musicians. Children may bring their own collections to the workshop or may use Museum specimens. It will be helpful if each child brings his own magnifying glass (a few will be available on loan at the Museum).

"Animals Without Backbones"

1:30 P.M. only
for ages 10 through 13

Maryl Andre in charge

An opportunity to examine animals without backbones and to find out about the great variety of forms within this group, from the paramecium to the giant squid. Youngsters may recognize the strange creatures that they observed on the sea shore during summer vacation, or learn where to find these animals during a winter vacation along warm sea coasts.

OCTOBER 10

"Cave Man to Civilization"

10:30 A.M., repeated at 1:30 P.M.
for ages 10 through 13

Edith Fleming in charge

A movie on the life of the cave men, which focuses on their hunting of prehistoric animals, opens this workshop. In the following discussion-demonstration period, boys and girls will examine real tools used by cave men thousands of years ago, learn how they were made, and compare them with tools of today.

(*Continued on page 8*)

FALL LECTURES

On Nature and People Around the World

THE FALL series of Saturday afternoon lectures for adults will be held in James Simpson Theatre from October 3 through November 28. Lectures begin at 2:30 P.M.; reserved seats are held for Museum Members until 2:25 P.M. Following is the complete schedule:

October 3

"Audubon's Wilderness: The River Years"

Leonard Hall

The publication of Audubon's *Birds of America* has been called the supreme ornithological achievement of all time. Now, for the first time, a brilliant documentary film brings to life the story behind this monumental undertaking. Naturalist Leonard Hall and his wife, Virginia, probed historical sources in America and abroad to reconstruct Audubon's historic journey in 1820 down the Ohio and Mississippi by flatboat to New Orleans, and the months spent at Oakley Plantation in Feliciana Parish. Following this trail, the Halls traveled thousands of miles to photograph the scenes and sounds Audubon knew. Hall accompanies their unique film with a narration based on Audubon's own day-by-day account of his adventures.

October 10

"Alone Across Asia"

Robert Moran

The comparatively unknown peoples of the world are the goal of Moran's travels across Asia. His journey begins in Syria, where he lived among Bedouins as guest of a sheik. In Persia, he wandered with a camel caravan; in West Pakistan he rode with fierce Baluchi tribesmen, and camped with Brohi tribes. Then across India to the highlands, where he photographed the Bondo clans at work and play. Journey's climax is reached in the high and misty regions of northern Burma. Through rough terrain, made hazardous by leeches, tigers, and snakes, Moran found the primitive Nagas and stayed to film war dances, the tatooing of women, and other aspects of their tribal life. An engrossing film study of some of the world's primitive peoples.

October 17

"Yugoslavia"

J. Gerald Hooper

Yugoslavia has bustling cities, quaint architecture dating from the Middle Ages, rural areas still untouched by modern ways, and an Adriatic Riviera second to none. All these are visited by Gerald Hooper, who synchronizes on-the-spot recordings of music and sound with color film to bring his audience the sense of being really there.

Highlights of the film are Lake Bled, beauty spot of the Julian Alps; Zagreb, cultural capital; the Island of Zlarin with its pretty girls and unusual jewelry industry; historic Sarajevo; opera in the Palace of Diocletian at Split; the medieval atmosphere of Dubrovnik—"Pearl of the Adriatic"; and St. Stefan, a fishing village transformed into one of the most unusual vacation resorts of Europe. Throughout the trip, Hooper records his vivid, sensitive impressions of people.

A fine example of a crystate formation caused by cell injury during the early life of a saguaro cactus. The life cycle of these "sentinels of the desert" is one of many unusual sequences in the film on "Arizona," to be presented October 24.

October 24

"Arizona"

Robert Davis

Davis contends that the 48th state to be admitted to the Union is a Utopia for every vacationer. Each film sequence strengthens his argument, beginning with Arizona's archaeological treasures, which are unsurpassed in any other area of the United States. Botanists and zoologists delight in Arizona's national parks and monuments, and its vast desert, fragrant with spring flowers. For the geologist there are seven periods of time to explore at altitudes from 137 to 12,600 feet. The anthropologist must visit Oraibi Pueblo on the Hopi Reservation; in this oldest continuously occupied village in the United States some of the finest examples of Indian arts and crafts are produced. Businessmen find interest in the growth of manufacturing, which has already overtaken the state's rich mining and agricultural output. And for children there is the pure fun of exploring ghost towns like Jerome,

(*Continued on page 8*)

FALL LECTURES
for Adults

(*Continued from page 7*)

while their parents browse the unique shops of Scottsdale.

October 31
"Hong Kong"
Karl Robinson

An adventure in understanding, Robinson's "Hong Kong" presents the teeming city against the background of age-old Chinese culture and skills. Unique among the political subdivisions of Asia, Hong Kong houses more than three million people, many of them refugees from Communist China. This staggering density of population has precipitated shortages of water and land, of housing and jobs. How a progressive government is aiding the assimilation of refugees, opening ways for them to contribute to the life of the colony, and encouraging industrialization to raise their standard of living, constitutes a dramatic chapter of our time. Karl Robinson enlivens his tale with myriad scenes from the life of the city: the harbor where ships discharge cargoes that keep the colony alive; the junks and sampans that house a floating population; the magnificent residences of Kowloon; the humanitarian efforts of the Church World Service; skilled work with brocade, ivory, and jade; agrarian life outside the cities; and the festivals of the Chinese year.

November 7
"Chile"
Nicol Smith

November 14
"A Naturalist in Southern Africa"
Cleveland P. Grant

November 21
"North of the Circle"
Finn Ronne

November 28
"The 1963 Mount Everest Story"
(Illustrated with color slides)
Maynard Malcolm Miller

Complete descriptions of the November programs will be published in next month's BULLETIN. ■

FALL WORKSHOPS
for Children

(*Continued from page 6*)

OCTOBER 17
"Rocks All Around Us"
10:30 A.M. only
for ages 6 through 9
Ernest Roscoe in charge

Rocks may be found almost every place and at any time of year. Children will handle many kinds of rock specimens, see Museum exhibits, and participate in demonstrations and chalk talks. They will learn how to recognize the main types of rocks, discover how rocks were formed, and how their past stories are revealed.

"Introduction to Rocks and Minerals"
1:30 P.M. only
for ages 10 through 13
Ernest Roscoe in charge

A beginner's introduction to rocks and minerals by means of specimen study, work with question sheets in the exhibit halls, a movie, and demonstrations. Subjects covered include: the major types of rocks, how they are formed, and the characteristics used in rock identification; also, what minerals are, the main physical properties used in mineral identification, and the major groups of rock-forming minerals.

OCTOBER 24
"Introduction to Fossils"
10:30 A.M., repeated at 1:30 P.M.
for ages 10 through 13
Ernest Roscoe in charge

A movie, examination of actual fossils, and work in the exhibit halls help youngsters to understand how fossils are formed, how they are recognized in the field and collected, and how they reveal the prehistoric life of the earth.

"Spices: Trail-Blazers to New Lands"
10:30 A.M., repeated at 1:30 P.M.
for ages 10 through 13
Marie Svoboda in charge

Spices were once worth their weight in gold. So much in demand were they that the search for precious spice plants led explorers to strange and distant lands. What were these spices, where did they come from, and how do we use them today? Children will have a chance to explore these questions through specimens and exhibits. Included are whiffs, sniffs, and tastes of the plant bits that played such an important part in the discovery of our own country.

If you wish to accompany your children to the Museum you will find that special arrangements have been made to help you enjoy the time. In the mornings the extra cup of coffee you had to leave behind to get here by 10:30 A.M. will be available. On October 3 there will be a tour covering progress being made in the major construction now under way to expand Museum research facilities. On October 10 we suggest that you take our new Acoustiguide tours. For October 17 and 24, we have planned an intimate view of current research-in-progress. These same tours will be open to you in the afternoons at 1:30 P.M. ■

MUSEUM NEWS

(*Continued from page 2*)

flight path is included along with a sketch of the craft's attitude during the final seconds of its drop toward the moon. The exhibit identifies the area of impact, which visitors will find easy to locate on the large, 19-foot relief model of the moon permanently displayed in Hall 35.

Other photographs in the special exhibit show Ranger 7 undergoing preflight checkouts at the hangar; the coupling to the Agena missile; and lift-off. ■

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Bulletin

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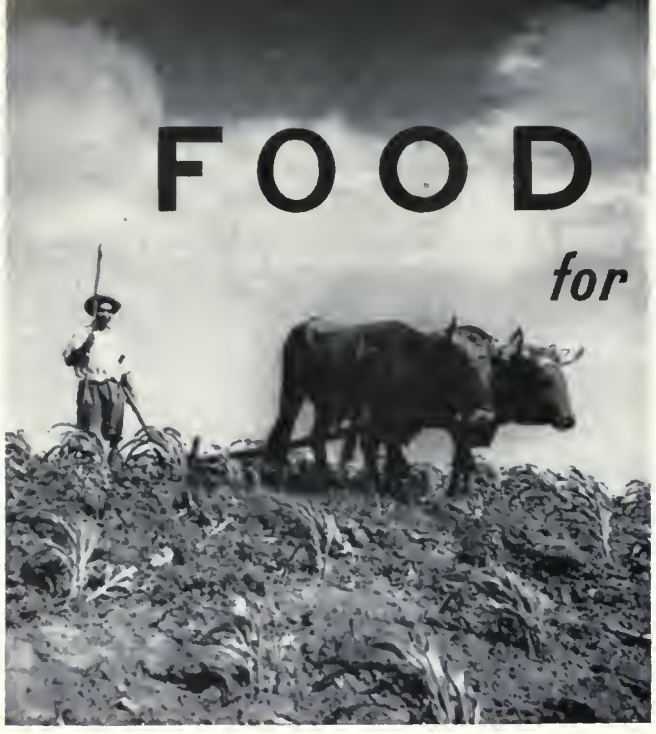


Ox or man power are still commonly used to till the fields in the mountains of Central America. Sloping fields are difficult or impossible to work with tractors. In addition, tractors and other imported farm equipment are often so relatively expensive that they cannot be used. (Photographs by the author.)

Food for Central America

Louis O. Williams

Chief Curator of Botany

Politically, Central America includes five republics: Guatemala, El Salvador, Honduras, Nicaragua, and Costa Rica. These countries are just about as diverse as the greater region, stretching from the Isthmus of Tehuantepec in Mexico to the Isthmus of Panama, that comprises biological Central America. Within the latter bounds flourish nearly all the types of vegetation to be found in the tropics of our hemisphere, except that characteristic of the high snow mountains.

The problem of producing sufficient food to support the population of any biological area involves the following principal considerations:

1. Man and his relation to the area: where he can live and progress; his increase in numbers.
2. The characteristic agriculture, soils, and climate.
3. The plants available as food, and what can be done with them.

My remarks will apply these considerations to the problem of food for Central America.

There are fairly good reasons to believe that man reached Central America perhaps as long as 10,000 years ago. How long man has been a farmer in this region is not at all certain, but it is my guess that rational agriculture or horticulture dates back not more than 4,000 years.

Man came into the area from Mexico, undoubtedly migrating down the mountain chain that extends, with only one minor break, through the region from northwest to southeast. He lived in the mountains because these were more acceptable than the lowlands as places to live, just as they are today. The mountainous area was the area of greatest opportunity.

When the population could no longer maintain itself in the highlands by simple seed-gathering and hunting, then agriculture must have had its beginnings. Sometime during this period the common field bean was domesticated and selections made from it. Native scarlet runner beans were even more easily taken over; their primitive types were surely much like those found in many parts of the highland region today. Other plants were brought into cultivation.

Also during this period maize came into the picture, either as a local cultigen or an import from elsewhere. Thus there were in the highland region two good protein food plants and one excellent source of carbohydrates. The diet was balanced and the stage set for one of the earliest population explosions in America. These foods at the same time provided the base for an incipient civilization, which was to become one of the most advanced in the world in its day.

It was not long before man began to push off the highlands to middle elevations. There the real explosion in his numbers took place, as well as advances in culture and civilization. Cultural centers were established: notable ones at Copán and Quirigua. In time, the agriculture that supported them began to spread farther and farther away—so far, indeed, that farmers could probably come to a center but once or twice a year.

It is my feeling that grass defeated this civilization of the Maya and related groups: that it was the principal cause of the downfall and abandonment of their cultural centers, and the causative agent that reduced the population to a fraction of its former numbers.

Forested lands may be cleared by fire, and, once cleared, three to five crops can be produced one after another before the soil becomes so poor that it is no longer productive. A greater disaster than loss of fertility, however, is the invasion of cleared lands by perennial grasses. Grass is not difficult to control if man has implements of iron with which to work, but it is catastrophic to the farmer who has no efficient cutting or digging tools.

Grass helped to drive the ancient Maya off the highlands; then again from the middle elevations of Guatemala and Honduras to the Yucatan peninsula, where a second renaissance took place. Still later, grass again figuratively drove the Maya into the sea. Because of this agricultural failure, the Central American aboriginal civilization was degraded to such an extent that it could offer little resistance to the Spaniards, and the conquest was carried out by a handful of men during the course of only a few years.

The injection of a new race of men into Central America did not have an immediate effect on food and agriculture. Eventually, however, the iron tools which the Spaniards brought helped to bring about a change that, while not entirely advantageous, did make tillage possible in spite of the invading grasses. The greater and easier production of food was no doubt a contributing factor to the greatly increased population growth following the conquest.

Now Central America is at the crossroad again. Nowhere in the area is there more food than is needed, and in some regions there is an undersupply that may amount to 40 per cent of optimum needs. At the same time, the population may be expected to increase by some 3 per cent each year. Insufficient food is, and will continue to be, at the roots of most social and political unrest in Central America.

It has been said that the characteristic subsistence type of agriculture in Central America is the same as it was 400 years ago. This is true only in part, for new tools and new ideas are beginning to penetrate even the farthest interior valley. Most of the food plants that were grown 400 years ago are the same as those grown today, with an important difference. The plant breeder and the agronomist have gone a long way toward producing higher yielding, more nutritious, and more resistant subsistence crops. Methods in agriculture are changing, though slowly.

On the other hand, many or most of the small subsistence farmers of Central America do not own the land they work. Their interest is to secure the greatest possible crop *this year;* they care little about what happens to the land in the process. Conservation, *this year*, fills no stomachs, allays no hunger pains. Thus, soils in great part are poorer today than they were a century ago. Moreover, due to erosion as well as lack of conservation, there is perhaps less arable land than a century ago.

Climate usually is said to be beyond the control of man, but climate in Central America has been adversely affected by man. Changes in the vegetative cover have altered rainfall and temperature patterns. The effects on runoff are all too obvious. A reversal of the trend, by adopting the measures necessary to control climate through improvement of the vegetative cover, will be difficult and immensely unpopular politically.

The kinds of plants available to pre-Columbian agriculture, and those available and used now, are not very different. With perhaps two prominent exceptions, the basic plant foods of most Central Americans are indigenous: maize, beans, manihot, potatoes, sweet potatoes, peppers, tomatoes, and several kinds of fruits. These make up the bulk of the food intake. Rice from the Old World is an important exception. It is the only one of the Old World food grains that grows and produces well in tropical Central America. Sugar cane of Old World origin, and the sugar from it, are also used all over the area. This is both a subsistence and a plantation crop.

Increased food production can be, and in fact is being, attained in Central America. Better agronomy, fertilizers and green manures, seed selection, plant breeding, increasing the kinds of food plants used, selection for more nutritious varieties, basic education, and agricultural education all are helping to improve the situation. The question remains, however, whether increases in food production due to better technology can offset parallel increases in the number of mouths that must be fed. ■

This field has been "cleared" recently. The men are planting it to beans. After planting 4 or 5 consecutive crops within the period of a year, the field may be abandoned for 5 to 15 years.

Indian corn and scarlet runner beans are commonly intercropped in the Central American highlands. Both plants are as American as blueberry pie.

CHICAGO NATURAL HISTORY MUSEUM

MUSEUM NEWS

This Month's Cover

THE Hallowe'en-like masks on the cover were made and worn by Iroquois Indians. When first discovered by Europeans, the Iroquois occupied the lake region and Mohawk Valley of northern New York, a fertile territory of considerable size. The five Iroquois nations, or tribes, were Seneca, Cayuga, Onondaga, Mohawk, and Oneida. The Indians who made and used these wooden masks were all members of the False Face Society.

The False Face Society was the most illustrious of a number of Iroquois secret societies that treated disease by spiritual means. This society also knew how to appease the horrible Flying Heads, evil demons without limbs or bodies that were believed to haunt the forests and send disease to the Iroquois.

In addition to the masks the properties of the False Face Society were songs, dances, elaborate rituals, charms, and musical instruments, including rattles made of turtle shells.

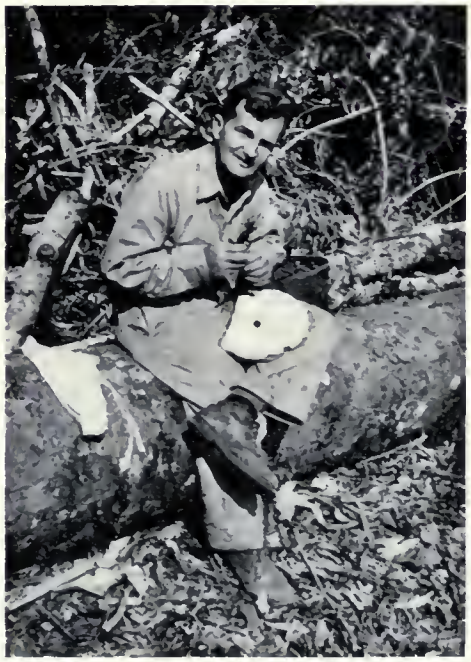
Membership in the False Face Society was open to men and women, and was achieved by dreaming of the necessity of joining or by having been cured of illness by the Society.

These masks and other cultural attributes of the Iroquois Indians as they were about a hundred years ago are on exhibit in Hall 5, on the main floor of the Museum.

Smallest Beetles to be Studied

THE National Science Foundation has given Chicago Natural History Museum a grant of $15,900 for two years to support research by Henry Dybas, Associate Curator of Insects, on the classification of North American featherwing beetles. These beetles are among the smallest insects known. A dozen of the tiniest of these creatures could rest quite easily on the head of an ordinary straight pin.

Featherwing beetles are common in many moist situations. There may be several hundred, for instance, in one square yard of forest floor; yet they are so tiny that many entomologists have never seen one. Completely unknown species are still turning up in such well-collected regions as the Chicago area.



Curator Dybas collects featherwing beetles from fungi in Panama.

The group has received little study in the past, in spite of the fact that featherwings are of interest to ecologists and soil biologists, as well as entomologists.

Featherwing beetles illustrate some special biological problems in a particularly instructive way. Prominent among these are problems associated with small size. Some featherwings are less than 1/75th of an inch long, which is smaller than some single-celled organisms. How can so much complexity and organization be packed into such a tiny space? As bits of biological machinery these beetles are miniaturized beyond the wildest dreams of space engineers.

The current study is intended to establish the basic classification needed for further work on problems connected with these smallest of beetles. Most of the financial support will be for technical assistance in making microscope slide preparations needed to study the tiny insects.

Field Work on Ancient Climates

DR. JOHN CLARK, Associate Curator of Sedimentary Petrology, and his assistant, Kenneth Kietzke, returned recently from six eventful weeks in the Badlands of South Dakota. They brought back to the Museum a collection of rock samples, petrified palm wood, fossil alligator bones, and other fossils, which will be most helpful in interpreting ancient climates. (Dr. Clark reviewed his interpretations in the BULLETINS of February and March, 1964.)

The climate of 1964 was not quite so helpful to the researchers as their collecting, however. A succession of violent storms immobilized their Power Wagon for a week, far out in the Badlands; lightning struck within fifty feet of their camp on several occasions. Fortunately, as a result of the storms, mud from the gullies was washed out and deposited in much the same fashion as occurred thirty million years ago; thus the beleaguered campers were able to observe "ancient" stream deposition at first hand. ■

From "The 1963 Mount Everest Story." Lecturer for the November 28th program is on the right.

FALL LECTURES

On People and Places Around the World

THE FALL lecture series for adults continues on Saturday afternoons during November. The programs are given in the James Simpson Theatre, beginning at 2:30 P.M. Reserved seats are held for Museum Members until 2:25 P.M. Following is the complete schedule, with descriptions of the November programs (descriptions of the October programs were published in last month's BULLETIN).

October 3
"Audubon's Wilderness: The River Years"
Leonard Hall

October 10
"Alone Across Asia"
Robert Moran

October 17
"Yugoslavia"
J. Gerald Hooper

October 24
"Arizona"
Robert Davis

October 31
"Hong Kong"
Karl Robinson

November 7
"Chile"
Nicol Smith

Viewers will welcome this delightful opportunity to tour, with Nicol Smith, one of the most progressive, yet charming, countries of the American continent. A thoroughly sophisticated traveler, Smith has sought out just those scenes of cultural and industrial life that most people would like to explore. His tour opens in the brilliant, modern city of Santiago, then moves by helicopter to the coast and the principal seaport, Valparaiso. A trout-fishing trip in the lake country provides a pleasant interlude before we move to primitive Tierra Del Fuego—Land of Fire, a name belied by its chilling winds and cold. Here on the southernmost tip of America we witness the spectacular break-up of a massive glacier. Then north to the high country, land of llamas, where Lake Chungara lies at an altitude of 13,800 feet. A look at three industrial areas follows: Iquique, where we put out to sea after sardines and anchovy and catch shark as well; Chuquicamate, the world's largest open pit copper mine; and the Atacama Desert, where Chile's white gold," nitrate, is found.

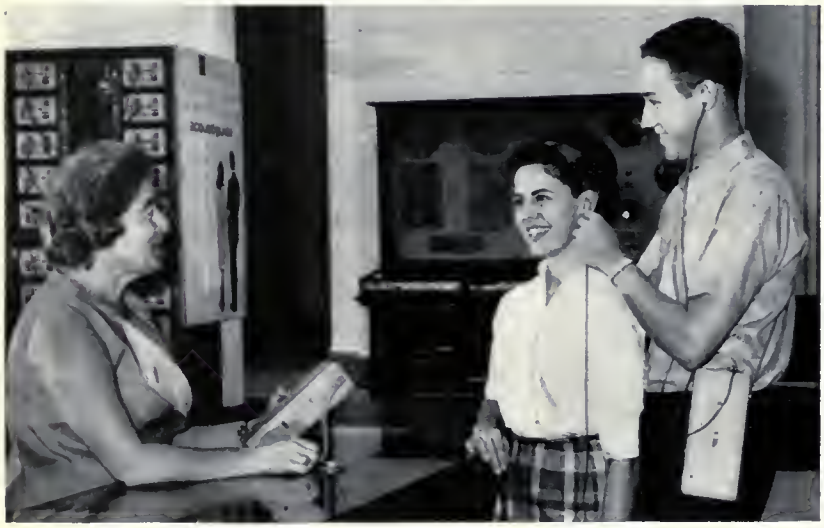
November 14
"A Naturalist in Southern Africa"
Cleveland P. Grant

Angola, the Rhodesias, and Mozambique—this is the territory. The subject? The magnificent spectacle of African animal life. Cleveland Grant, a noted wildlife photographer, took to Africa all the skills gained from years of experience in filming birds and big game of the western United States, Canada, and Alaska. The result is a filmed "bag" that includes 40 species of birds; 20 varieties of African antelope; scenes of hippo, rhino, zebra, giraffe, leopard, lion; and some of the finest elephant films ever to come out of Africa. It was in the Rhodesias that Grant followed a herd of hundreds of elephants in wilderness along the Mozambique border. There, too, he made movies on several of the great game ranches—Buffalo Range, Henderson Ranch, and Lochinvar with its 17,000 lechwe. He visited the famous bird concentration flats along the Kafue River and filmed wildlife along the Zambezi from Victoria Falls to Kariba Dam. His final safari was into a wild area of Mozambique, where most of the big game species of Africa

(*Continued on page 7*)

"Turn right, and look into an African King's house"

YOU ARE listening to the voice of your personal tour guide, speaking softly in your ear. "Please continue further into this hall now," the voice says, "to the Cameroons king's compound directly ahead. . . . While you're walking there, we'd like you to hear the sound of African drums—the same drums which you will see in the drum shed beside the king's house."



Museum visitors Judith Kenerpp, of Mt. Carmel, Illinois, and Charles R. Madden, of Evansville, Indiana, decide to share their Acoustiguide tour. From Mrs. Ethelyn Ann Sacks at the Information Desk they rent a machine equipped with two earphones. Here, too, they decide whether to take the tour on anthropology (the story of mankind), or the general tour on the world of nature (geology, botany, zoology).

Obediently you move forward and take up the indicated position in front of a window inserted into the wall of the house. Your guide tells you how the royal dwelling was made, points out the finely carved doorposts and pillars, and explains the significance of the designs on the furnishings and walls. "The leopard," you learn, "symbol of royalty, is painted over the bed. . . . The king's favorite wife sleeps on a mat beside the bed. The king has 86 wives, but, as he often explains, he really likes only a dozen or so of them—the rest are merely token wives, inherited or taken for political or diplomatic reasons."

After hearing how the king holds court and passes judgment on legal cases, you are directed to "turn around, and then follow the blue arrows down the short stairway into Hall F . . . to the New Zealand Maori Council House." But perhaps you would prefer to linger a while among the African drums and gods. Simply turn the knob on the lightweight machine hanging at your side, the voice goes off, and you may

"When Captain Cook was newly-arrived in Hawaii in 1779, he was thought to be a white god, and in a native ceremony was placed near this idol." Mr. and Mrs. John Cronin, of Memphis, Tennessee, pause at this interesting point in their anthropology tour.

Photographs by John Bayalis

Miss Dagmar Pultz, a young visitor from Germany, turns the volce of her Acoustiguide louder to hear: "Horses were the prized possession of the Plains Indians. They were used in the hunt, on the warpath, and also as the moving van to transport the camp from one site to another. . . . This operation was, of course, the responsibility of the women of the tribe."

browse as long as you like until you are ready to continue your tour.

This is only one of the many advantages of the new tape-recorded Acoustiguide tours now available at the Museum. Your Acoustiguide is a small, tape playback machine, which is carried on a strap around your neck and fitted with a featherweight earphone. It replaces the Museum's former radio transmission guide system. Two pre-recorded, 45-minute tours are offered: one on the story of mankind (through the anthropology exhibition halls); the other on the world of nature (through halls devoted to geology, botany, and zoology). The tours are prepared and authenticated by the Museum's scientists and educational staff; the voice you hear is that of a professional narrator. Each tour costs 50 cents; or, for 75 cents, two persons may share a recorder equipped with two earphones. Acoustiguide tours may be taken completely at your own pace, interspersed, if you like, with periods of rest, independent study, or refreshment.

We invite you to come in soon and take advantage of this technological advance that can make your next Museum visit more enjoyable and meaningful than ever before. ■ (PRN)

ınd Homer V. Holdren

Far left: "These elephants are shown in a fighting pose, just as they appeared when Carl Akeley, his wife, and members of their party came upon them in the jungles of Africa. . . . The elephant on the right is missing a tusk . . . which had caused a constant torment that turned him into a troublemaker, or rogue. . . . Akeley shot the rogue, while his wife brought down the two-tusker." Enjoying the first stop on the nature tour is Mr. and Mrs. Charles E. Moseley and their family, of Nicholasville, Kentucky.

Left: Three college students, Stanley Radosch of Indiana University, William Cregar of the University of Chicago, and David Denison, of Southern Illinois University, hear their Acoustiguide identify this "72 foot long Brontosaurus, our largest dinosaur skeleton. A plant-eater who weighed 30 to 40 tons, Brontosaurus lived about 155 million years ago. . . . His habitat is depicted in the Charles Knight mural which you can see on the far wall. . . . In the painting the dull grey of his skin is just guesswork; Bronty might have been any color or any combination of colors, including orange with purple polka dots—but probably not!"

FALL LECTURES
for Adults

(*Continued from page 5*)

still roam as they did a thousand years ago.

November 21

"North of the Circle"

Finn Ronne

During the International Geophysical Year, Captain Finn Ronne, USNR (ret.), capped his distinguished career as a polar explorer by accepting the post of military commander and science leader of the Ellsworth Station in Antarctica. He is equally at home north of the Arctic Circle. Ronne was with the first United States task force to undertake the building of airstrips and weather stations in the Canadian Arctic and along the northern shores of Greenland. Later he returned to film Eskimo life in Greenland and to organize trips to the Norwegian and Soviet Arctic stations on Spitsbergen. His fine color film covers all these explorations. We gain an intimate insight into Eskimo life, and share the drama as men of science battle the forces of nature to extend man's knowledge of his environment. There is add-

(*Continued on next page*)

(*Continued from previous page*)
ed excitement when Captain Ronne focuses his camera at close range on the monarch of the Far North, the great white polar bear; records the expeditionary vessel's struggle against treacherous ice-floes; or follows the routes of Amundsen, Ellsworth, and Byrd to their starting point for flights over the North Pole.

November 28

"The 1963 Mount Everest Story"

(Illustrated with color slides)

Maynard Malcolm Miller

Dr. Miller's stirring account of this successful expedition begins with the departure from San Francisco in January; continues through the long march across Nepal from Kathmandu to the upper reaches of the Khumbu Glacier; and ends triumphantly at the dramatic moment of double victory on Mount Everest's summit, when two men who ascended the previously unconquered west ridge meet two others who had come up the Col route on the same afternoon.

Dr. Miller, who received his Ph.D. degree from Cambridge, was in charge of the geological program of the Mount Everest expedition. His responsibility was to study the high glaciers and geology of the jagged peaks bordering remote Tibet. Along the way, he tells the story of the unusual scientific program carried out at altitudes between 16,000 to 25,000 feet, and recounts the evidence of psychological and physical stress suffered by expedition members as they climbed past glaciers and rock ridges into the rarified air of the world's highest mountain. The anxious hours preceding and following the conquest, the many episodes of crisis met and overcome, are made vivid with the aid of Kodachrome slides. ■

In Memoriam
REUBEN M. STRONG
1872-1964

DR. REUBEN MYRON STRONG, Research Associate in the Museum's Division of Anatomy since 1946, died August 11 in Petosky, Michigan, where he was spending the summer. His death at the age of 91 brought to a close the career of a remarkable man whose productivity and scholarly inquiry in several diverse fields spanned a period of more than seven decades and continued until his final illness. He is survived by a daughter, Madelaine, a resident of New York City.

Dr. Strong was born October 8, 1872, in North Greenfield (now a part of West Allis), Wisconsin, the descendant of English and Irish ancestors who first came to this country in 1630. After graduation from high school in Wauwatosa, Wisconsin, he was briefly a country school teacher—with janitorial responsibilities—in a neighboring community, and from his salary of $40 a month saved sufficient money to enter Oberlin College, from which he graduated in 1897. On receiving his Ph.D. degree from Harvard in 1901, Dr. Strong entered upon a teaching career that continued more than forty years, in the final decades of which (1918–1946) he served as Professor and Chairman of the Department of Anatomy of Loyola University School of Medicine.

The scope of Dr. Strong's interests and abilities are evidenced by the fact that he, a specialist in anatomy, on occasion not only taught chemistry, physics, botany, and zoology, but also during his earlier years sometimes assisted in the coaching of football and track. A member of numerous learned societies and Fellow of the American Ornithologists' Union, Dr. Strong became an officer of many and the president of several, including the Wilson Ornithological Society, of which he was also a founder. His scientific publications include more than 125 titles, of which almost half are in the field of ornithology.

The ornithological publications of Dr. Strong date back at least to 1891 and include studies of avian anatomy, neurology, pigmentation, behavior, and conservation. But his greatest contribution to the study of birds, and one for which he justifiably received the widest acclaim, is his *Bibliography of Birds* published (1939, 1946, 1959) in four volumes of 1,641 pages by the Chicago Natural History Museum. This monumental work, appropriately cross-indexed, makes easily available for the first time the authors and titles of some 25,000 technical papers that constitute the world's more important literature on birds.

Formal retirement in 1946 was, for Dr. Strong, seemingly but an incident that altered little, if at all, the work patterns of a lifetime. During his remaining eighteen years he occupied an office provided by the Museum, where he could be found at work almost daily, except when similarly engaged at his summer home in Michigan. Much of his time was devoted to anatomical studies of albatrosses, but during his last years Dr. Strong became increasingly involved in matters of conservation and was an officer or member of various conservation societies. A modest man, cheerful in outlook, and ever responsive to those who sought his help, Reuben Myron Strong will long be remembered with admiration by his former students, the staff of the Museum, and his many friends elsewhere. ■

EMMET R. BLAKE

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CHICAGO NATURAL HISTORY MUSEUM

Bulletin

Vol. 35 No. 11

November 1964

An overall view of the Snowflake site. A grid has been staked out over an area approximately 40 to 50 yards square. Piles of sifted dirt, excavated from each section of the grid, are visible to the left. Beneath the clump of junipers at the upper right, slab-like sandstones, projecting from the ground, first called attention to the site as a possible habitation of prehistoric Indians.

An archaeologist's view of a Desert Culture house. Note the circular distribution of post holes marking the outer walls of the dwelling. The narrow, elongated depression to the left is the floor of the entrance tunnel that opened to the east. Between the entrance passageway and the house are remains of a low, curved wall of stone slabs. Several storage pits are visible; the largest (marked with a meter stick) is more than a yard deep. Within it were found the broken remains of its ring-slab cover and charred whole corn.

PAULA R. NELSON

North

WHAT may well prove to be the oldest human dwelling ever discovered in the United States has been excavated near Snowflake, Arizona, by an archaeological team from Chicago Natural History Museum led by Dr. Paul S. Martin, the Museum's Chief Curator of Anthropology.

The prehistoric people who built the house belonged to what is known as the Desert Culture, which flourished from Idaho south to Mexico, between the Rocky Mountains and the Sierra Nevadas, from 11,000–9,000 B.C. until approximately the time of Christ. The house was built during the later stages of this culture.

It was the Stone Age, and Desert Culture people did not know the art of making pottery. They obtained food by gathering the roots and fruits of wild plants and hunting small animals with stone-pointed weapons. Although some of their populations developed agriculture as early as 3,000 B.C., no evidence of cultivation had ever been found within the upper Little Colorado River drainage area, of which Snowflake is a part. Throughout their history—as far as archaeologists knew—Desert Culture people lived only in caves or, possibly, in impermanent camps.

It now appears, however, that important aspects of this picture must be revised, in light of the discoveries made by Martin and his assistant, James Hill, a research assistant and graduate student at the University of Chicago. These discoveries reveal that, somewhere between 4,000 B.C. and the time of Christ,

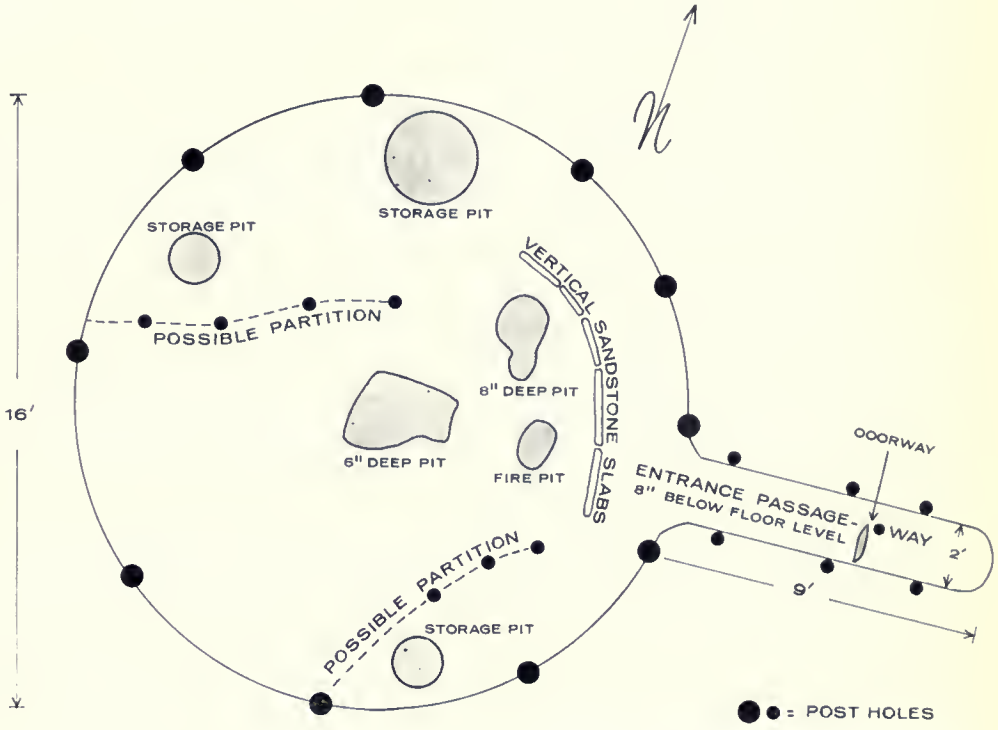
American Man's Oldest Home?

certain Desert Culture populations not only cultivated corn, but built houses that were quite unlike any dwellings previously known from North America, and clustered them together in small villages which may have been fortified by stone walls.

It was Hill who spotted the nearly obliterated signs that men had once lived, thousands of years ago, on the Snowflake site. "You can imagine," Martin suggests, "what it was like to identify the remains of human habitation after two thousand years had passed if you think how difficult it would be to relocate a camp site you made in the woods even 50 years ago."

What Hill and Martin discerned were patches of dark, charcoal-colored, ashy soil on the surface of the ground; bits of chipped stone mixed with other cultural debris; and a few slab-like stones—later interpreted as part of a wall—barely protruding from the ground beside a clump of trees.

On the strength of this evidence, the Museum archaeologists, together with a group of carefully chosen and trained students, began systematic digging. After marking a grid over an area about 40 yards square, they excavated each square of the grid, keeping the soil from each section separate from the rest. Digging was done with picks, shovels, trowels, and—in the last delicate stages—with whiskbrooms. All the excavated earth was then sifted through a screen. The relics of human habitation—mostly chipped stone projectile points, knives, scrapers, and choppers—were carefully marked according to the section of grid and sedimentary level of the ground in which they were found.



A reconstruction of the floor plan of a Desert Culture house. In the drawing, the orientation of the lower photograph on the opposite page is reversed. (Drawing by M. Pahl.)

At a level scarcely a foot below the earth's surface, Martin and Hill came upon the first remains of a human dwelling. These consisted of post holes, with bits of charred cedar wood still in them, set in a circular form. Immediately the archaeologists knew these were the remains of a building entirely different from the pit houses built by later inhabitants of the region. The newly discovered dwelling had been constructed above, not under the ground.

The Museum party continued excavating until the house was fully unearthed. It measured about 16 feet in diameter. Cedar saplings, set upright at irregular intervals, had supported its walls. Probably the walls themselves

(*Continued on next page*)

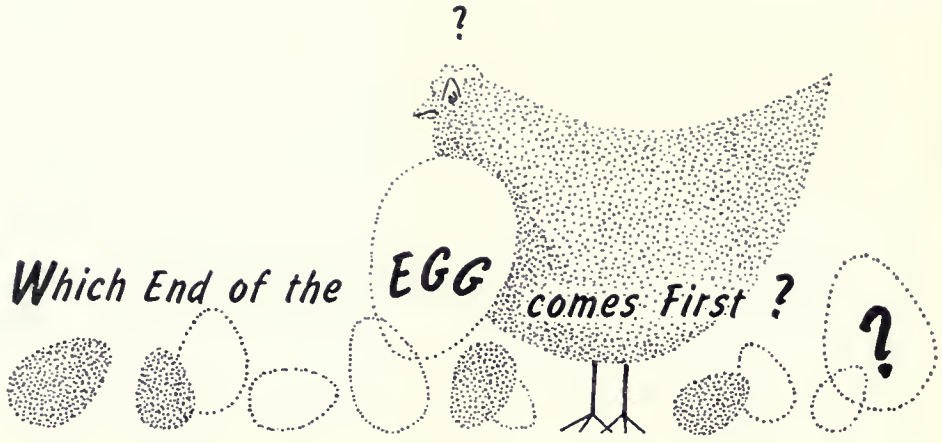
(*Continued from previous page*)
were of wattle and daub construction in which clay is applied to thatched twigs. There is no way of knowing whether the roof was arched or domed. Entrance to the house was through a mud-plastered, tunnel-like passageway leading out to the east—reminiscent of the passageways Eskimos crawl through to enter their igloos. Just inside the house, a low, curved, stone wall protected a fire pit from drafts.

Beneath the floor of the dwelling the inhabitants had hollowed out three storage pits; in the largest of these, the Museum party found whole charred corn. This grain storage chamber was protected by a ring-slab cover of chipped sandstone, which was found broken within the pit. Also inside the home were several stone metates and manos, tools used for grinding corn into flour.

The chipped stone implements that were recovered from the site make it possible to assign the house to the Desert Culture. The presence of corn, however, is unusual in a habitation which Martin and Hill believe antedates the pit house builders who are known to have practiced agriculture in this region around A.D. 400. The Snowflake site thus provides the first evidence of grain cultivation by Desert Culture people living in the Upper Little Colorado drainage area. Final determination of the age of the dwelling awaits the results of carbon-14 tests now being made on the charred house posts and the corn itself.

As THE excavation proceeded, remnants of 8 to 10 more houses were revealed. Materials recovered from all of them are now in the Museum. During the winter, these data will be intensively analyzed by statistical methods in the hope of finding answers to such questions as where, within the village, was food preparation done? Cooking? The various stages of stone tool-making? How were these tasks divided among the men and the women? Where on the site did different family groups, or clans, live? Was there any division of labor among the clans? The answers to some of these questions will probably have to await further intensive digging now being planned for next summer.

Dr. Martin, who is president of the American Archaeological Association, is a pioneer in the use of statistical research to recover information about the social organization and actual day-to-day manner of living of extinct peoples. The attempt to answer such sociological questions is a new trend in archaeology, made possible by the application of experimental methods, the collection of statistically valid samples, and the use of computers to analyze data. Such methods reinforce the archaeological discipline as a social "science." The present discovery should enlarge still further the exciting promise of this new kind of archaeological research. ■



Austin L. Rand
Chief Curator, Zoology

THE 918-page book called *The Avian Egg* contains more information about hens' eggs than most people will care to know. Between the quote on page 1 about a bird's egg being the most perfect thing in the universe, and the paragraph on page 806 on "other art forms," there is an exposition of the egg from genesis through morphology and chemistry to preservation and industrial uses. These last include uses in cakes, cosmetics, and in the leather industry.

The question of which came first, the chicken or the egg, is not touched on by the authors, A. L. and A. J. Romanoff of Cornell University. But they do settle the question as to which end of the egg, the blunt or the sharp end, is laid first. It is strange that so simple a question should have been so long unanswered. In the historical preamble to the answer, a nice touch of erudition is given the discussion by a reference to the classics, among which Aristotle's comments seem the first recorded. In the early 1800's there was keen interest in the subject. But only in the early 1900's was observational and experimental evidence gathered and presented in quantity and quality that seems to settle the matter.

The question as to whether the contracting of the appropriate muscles forces the egg down the hen's oviduct with pointed or blunt end first seems capable of two possible answers. But actually there are three. Curiously, about 90 per cent of the time hens' eggs have the shell formed around them while the sharp end points down the oviduct, but only 70 to 80 per cent of the eggs are laid sharp end first. Some 20 to 30 per cent are laid blunt end first.

Having answered the question with "yes and no," it now remains to give the third answer to complete the survey. It appears that sometimes the descending egg pushes a bulge in the thin wall of the oviduct, and in being squeezed along it rotates, end for end. Thus it makes part of its journey with one end first, part with the other.

The Romanoffs should know, being associated with the Poultry Husbandry of Cornell University. Further, from internal evidence, the very nature of the answers invites the confidence of biologists. Very often we find our answers, "yes," "no," and "sometimes." It is the nature of life. ■

Museum News

Shell Club to Meet

The recently organized Chicago Shell Club will meet in the second floor meeting room of Chicago Natural History Museum on Sunday, November 8, and on Sunday, December 13, at 2:00 P.M. Meetings of the club are open to all persons interested in shell collecting or shells as art objects, and Museum Members, especially, are invited to attend. ■

Black Hills Field Study

Dr. Bertram G. Woodland, Curator of Igneous and Metamorphic Petrology, has returned from a five-weeks' field trip to the Central Black Hills region of South Dakota. There he continued his study, begun last summer, of the deformations in metamorphic rocks (see the three photographs on this page). While in the field he recorded much data on folded rocks and collected numerous specimens, including many complete folds, for detailed laboratory study. These specimens are carefully marked in such a way as to enable him to restore their orientation prior to collection. Thus all new information derived from laboratory analysis may be referred to true geographic coordinates.

The object of Dr. Woodland's work is eventually to arrive at the geometry of the deformed rocks and to elucidate the history and mechanics of the earth movements that have affected this geologically complicated area. ■

Staff Notes

Dr. Austin L. Rand, Chief Curator of Zoology, and two members of the Division of Birds, Mr. Emmet R. Blake, Curator, and Mr. Melvin A. Traylor, Jr., Associate Curator, attended the annual meeting of the American Ornithologists' Union held recently at the University of Kansas, in Lawrence. Dr. Rand is outgoing President of the A.O.U. Mr. Blake is a member of the Union's Check-list Committee, and Mr. Traylor is Chairman of the Endowment Committee.

In September Traylor attended the Second Pan-African Ornithological Congress in Pietermaritzburg, South Africa. His paper on the taxonomy of a group of African birds, the Combassous, which he gave at this meeting, developed out of his work for *Peters Check-List of Birds of the World*. After the Congress Traylor spent a month examining ornithological collections in a number of museums in South Africa and the Rhodesias.

Mrs. Meta P. Howell, Librarian, attended the annual convention of the American Library Association held re-

(*Continued on next page*)

Types of structure being studied by Dr. Woodland are shown in these outcrops. Far left: crests of flat-lying tight folds. Left: trough of fold plunging steeply toward viewer (hammer indicates scale). Above: close-up of small-scale steep folds (6-inch ruler indicates scale).

cently in St. Louis. The Associate Librarian, Mr. W. Peyton Fawcett, represented the Museum Library at the annual convention of the Special Libraries Association in St. Louis, and at the Conference on Rare Books in Natural History, held at the University of Kansas, in Lawrence.

AT MEETINGS of the Midwest Museums Conference held in Davenport, Iowa, Dr. Louis O. Williams, Chief Curator of Botany, reported on the Museum's botanical research and exploration. Mr. John R. Millar, Curator Emeritus, also represented the Museum at the Conference.

THIS fall the head of the Museum's Engineering Division is undertaking the additional role of teacher. In the adult education program of the Leyden High School, Mr. Leonard Carrion, Chief Engineer, will teach a course in steam plant operation.

MUSEUM hours from November through February are 9 A.M. to 4 P.M. on weekdays and 9 A.M. to 5 P.M. on Saturdays and Sundays.

DR. M. KENNETH STARR, Curator of Asiatic Archaeology and Ethnology, has been busy during the summer and fall with a number of activities designed to make the Museum's Chinese collections and exhibitions better known to the public. In June, during a half-hour program on Chicago's educational television station WTTW (Channel 11), Dr. Starr showed and explained a wide variety of Chinese materials dating from the last dynasty. In August he lectured on the art of the Ming and Ch'ing dynasties at the Art Institute of Chicago. Last month he arranged an exhibition of Chinese rubbings for the Museum of Fine Arts in Santa Fe, New Mexico, and lectured at the exhibition opening. The rubbings lent for this exhibition, which continues through November 22, are all from Chicago Natural History Museum's outstanding collection. Early this month, Dr. Starr gave a gallery talk for a group of Mount Holyoke alumnae and their guests. The talk took place in the Museum's recently completed hall, "China in the Ch'ing Dynasty, 1644–1911." ■

Chinese writing materials—rare colored inks in stick and cake form, brushes, and an ancient ink-mixing palette—are shown below. All are displayed in Hall 32.

FROM THE BOOK SHOP

FROM THE four corners of the earth, a gathering of exciting gifts for Christmas, birthdays, and festive occasions all through the year has been assembled. During your holiday visit to the Museum, browse a while at The Book Shop to find the perfect gift.

Books

Be a "fireside adventurer"—choose from a complete line of publications dealing with all phases of natural history: Museum Storybooks, beautifully illustrated volumes for children or adults, many written by Museum staff members.

Jewelry

Natural leaves from Austria, gold plated and mounted as a unique pin.

Multi-colored, semi-precious stone necklaces from India.

A variety of carved "tiger eye" or jade necklaces.

Mosaic pins from Italy in striking and unusual patterns.

Primitive Art

Reproductions of famous Museum pieces which skillfully capture the beauty of the ages.

For Hobbyists

Butterflies: domestic and exotic South American species, mounted and identified.

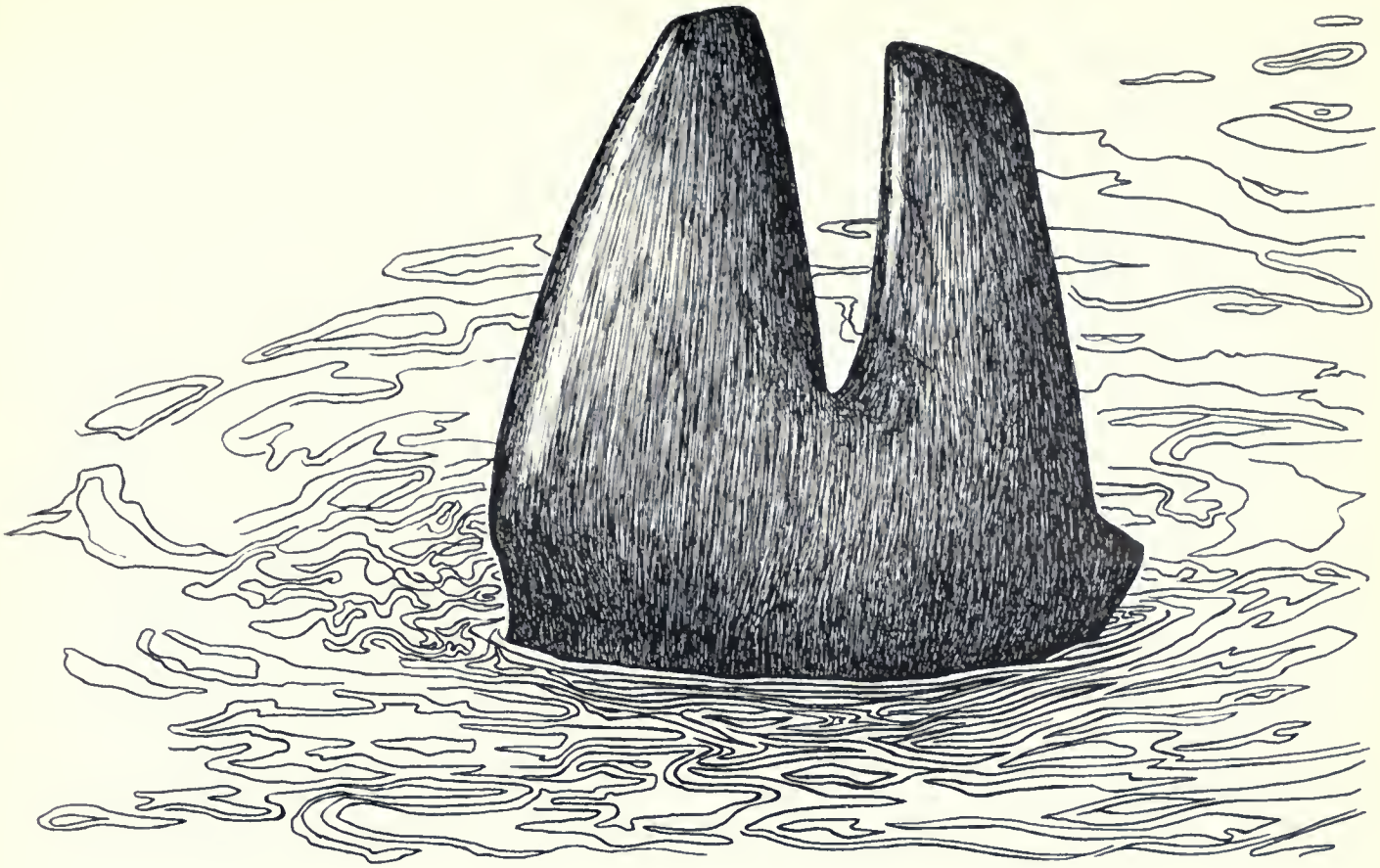
A "rock hound" on your list will be delighted with our varied collections of minerals.

Scaled models of prehistoric men and monsters are for the student and hobbyist.

For Children

From Australia: koala "bears" made from genuine kangaroo pelts.

Miniature families of cats, dogs, or horses in bone china. ■



A MYSTERIOUS ENCOUNTER

Joseph Curtis Moore
Curator, Mammals

FROM the rail of a banana boat moored to the bank of the Miami River, in Miami, Florida, I stood looking toward the place where the river empties into Biscayne Bay. A mile or two beyond, the bay opens into the vast and enigmatic Atlantic Ocean. I was alone, because it was still early morning, and most of the inhabitants of Miami—a city in the midst of a cold snap—were still shivering in bed. I had pencil and notebook in hand, and the visibility was good.

As I looked, a fantastic shape began to rise from the bay no more than 300 feet away. Slowly and awkwardly it came up, wavering from side to side, until about three feet of it could be distinctly seen. I watched intensely to observe every detail of its form and movement. What could it be? I had studied the whales and dolphins of these waters. There are no seals. I *should* be able to identify this thing. It was black. It had no symmetry. It tapered upward somewhat toward an apex that was unevenly and bluntly bifurcated. Its awkward movements were apparently those of something alive. Could the flipper of the huge and very rare trunk-back turtle be like that? I didn't see how. Presently the thing began to submerge, continuing to stagger, and soon was gone. It had been exposed perhaps between 60 and 90 seconds.

Whether anyone else had seen it I have no idea. Nor could I care. What chance that a casual observer might re-

(*Continued on next page*)

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cognize what I had seen? An articulate man at all acquainted with the vast folklore on mysterious monsters might carefully cherish such an observation, develop the details of its impact on his own emotions, and create a legend to puzzle his family and friends for years to come. A literate man might add his observation to the large body of literature about marine creatures whose observed features do not identify them as animals known to science.

Before the monster showed its hand, I had been observing the sea cows that occasionally billowed up from the depths beneath the boat rail. Low temperatures had attracted them here to loll in the flow of warm waste water from a nearby power plant. When one rose for a breath it might dawdle for a moment before sinking back out of sight for another ten minutes. Identifiable individuals drifted around in an eddy beneath the rail. I was watching for identifying notches or scars on them and sketching them onto manatee outlines stenciled in my notebook. In spite of my mysterious chimera the manatees continued to show themselves, and this kept me too busy to despair over my failure to identify the monster's gesturing hand.

Some minutes later, to my joy but further perplexity, the strange figure rose again only 200 feet away. The same features could now be seen even better. It turned its side slowly to me, showing itself to be thin, tapering upward to perhaps two inches at the top. The form definitely suggested an appendage of some large sea animal. But still I could think of no possible one. My pencil swiftly sketched its shape. The monster sank out of sight leaving me more baffled than before. What could be done?

Some minutes later a manatee with a small H-shaped scar on its back surfaced gently ten feet away. Recognizing this as an individual that I had known from five years before, I warmed up at this extraordinary success. Half an hour later when several more manatees had been recorded, a particularly black sea cow with a calf clinging to its back rose directly beneath me to within five feet of the deck on which I stood. Perhaps the old manatee saw me involuntarily crane forward (one rarely sees a wild baby manatee at all, let alone one riding piggyback). At any rate the old sea cow did not quite surface for a breath but arched smoothly back down into the murk. In doing this, it showed its unbelievably mangled tail. This was the hand of the monster! My ready pencil quickly sketched the form onto the next stenciled manatee outline in my notebook. Considerably later the same manatee and baby, now presumably drifting around the eddy, rose beneath me twice more, enabling me to check the details of the sketch.

The resulting drawing (page 7) shows the upper view of the extraordinary mutilation of the tail. The sea cow's wounds were healed, and both it and the calf were plump, but the fact that the remnant of tail was three or more times thicker than is natural suggests that this poor female had been pared close to a critical point. This abnormal thickness, of course, accentuated the grotesqueness of the vestige.

A later tally revealed that four-fifths of the dozens of manatees that I came to know individually had their tails scarred, notched, or sliced. In many cases this was obviously done by boat propellers.

During the many hours that I have recorded the behavior of free, wild manatees I have more than once observed a submerged animal protrude its (normal) tail above the surface vertically some 6 to 10 inches, wave it languidly back and forth, and then slowly withdraw it from sight.

The probability must be exceedingly small that an observer sufficiently ready with sketchbook or camera would observe a wild individual so extraordinarily mutilated, of a species so seldom seen by man, performing so unusual an act. And if he did, what chance would there be that he should again see the same individual under conditions enabling him to identify it as an animal known to science? Not much. Nonetheless, this one instance when a monster *did* reveal its true identity may signify the end of an era. Sea monsters may have to face up to a small but increasing risk. When one of them attempts to bring off a mystifying appearance, it may encounter a biologist whose investigation just happens to require that he be standing there ready with sketchbook or camera, able to wait until the monster discloses its identity. ■

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THIS MONTH'S COVER—taken from a Museum exhibit of manatees—pictures Dr. Moore's monster in its natural habitat. The exhibit, which is located in the Hall of Marine Mammals (Hall N) on the Museum's ground floor, is featured during November.

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CHICAGO NATURAL HISTORY MUSEUM

Bulletin

Vol. 35 No. 12
December 1964

STANLEY FIELD
1875-1964

Chicago lost one of its finest citizens and Chicago Natural History Museum lost its greatest builder with the death on October 28 of Stanley Field in his 90th year. In a life that was as distinguished as it was long, he devoted his talents to the business and cultural life of Chicago with an intensity matched only by his generosity. Of all the institutions with which he was associated, he loved the Museum most. It grew great because of him.

Mr. Field was born in Manchester, England, on May 13, 1875. In 1893 he came to Chicago to work at Marshall Field & Company, of which his uncle was founder and president. He remained associated with the company until his death 71 years later, serving as First Vice President, member of the Board of Directors, and, since 1939, Chairman of the Executive Committee. In 1918, he resigned the active administrative responsibilities of First Vice President of the store to allow himself to devote more time to the Museum and to other civic responsibilities.

His association with the then Field Museum of Natural History began in 1906 when founder Marshall Field asked him to become a Trustee. Although he had had little contact with the Museum or with natural history, he acceded to his uncle's request and soon, in 1908, was elected President and headed the institution for more than 56 years. It was during these years that the Museum, a small and relatively unknown institution when he began its guidance, grew to maturity and world-wide distinction. His gifts to the Museum exceeded two million dollars, but he gave himself in even greater measure. His interest and gifts extended into every aspect of the Museum's broad scope, from the physical plant to scientific research in each of its four fields of study, to the exhibition program, to the establishment of an employees' pension fund. Because of this very breadth of his interest the Museum grew in a proportioned and balanced fashion, gradually reaching the stature that it enjoys today.

The largest responsibility Mr. Field assumed for the Museum was the construction of the present building, which was opened to the public in 1921. When Marshall Field's original bequest of $4,000,000 for the new building proved to be far short of the required amount, Stanley Field personally assumed the responsibility of securing the additional millions required. This he did, contributing for many years from his own funds to this goal. Later, when he saw an outstanding need at the Museum for which funds were not available, he often authorized the expenditure and paid the cost himself.

Mr. Field's contribution to Chicago ranged far beyond the Museum. He worked closely with John G. Shedd, who contributed the funds to build the Shedd Aquarium, and he served for 27 years as its President after supervising the Aquarium's planning and construction. When the Chicago Zoological Society built the Brookfield Zoo, he accepted the chairmanship of the Building Committee and later was Chairman of the Executive Committee of the Zoo. Children's Memorial Hospital and Chicago Child Care Society received years of his service and always, concurrently, his gifts.

His business associations, in addition to that with Marshall Field & Company, included positions on the Boards of Commonwealth Edison Company, Public Service Company of Northern Illinois, Continental Illinois National Bank and Trust Company, the Chicago Milwaukee and St. Paul Railroad, and Illinois Central Railroad. In 1917 Mr. Field was asked to assume responsibility for the purchase of all Red Cross supplies, with the military rank of Major. By the end of the war, he had been placed in charge of all supplies and transportation for the Red Cross.

(*Please turn to page 8*)

Youth

The new Museum President—1908

With the Prince of Wales—1924

With sculptor Malvina Hoffmann in Paris—1934

With former Mayor Kennelly at Trustees' Dinner honoring 40th anniversary as President—1949

The 40th Anniversary Dinner

Acquisition of Fuller Collection—1958
With former Director Gregg

At work

EXHIBIT COMPLETED

BIRDS of the WORLD

EMMET R. BLAKE
Associate Curator, Birds

American sun grebe (Heliornis fulica)

Gray-necked wood rail (Aramidaes cajanea)

THE MUSEUM's Synoptic Series of Birds of the World is now complete with the installation of a new exhibit showing representative birds of 12 families that comprise the order Gruiformes. This cosmopolitan assemblage of about 200 species includes cranes, rails, bustards, and related families. Some live on a single island while others have a virtually world-wide distribution. All share fundamental morphological characters that indicate a common ancestry, but the several families, and the species of some of the families, may be quite different in appearance.

Rails, which include the gallinules and coots, are the most widely known of the families in this exhibit, as they are virtually cosmopolitan. Eight of the 132 species occur commonly in Illinois, but the local forms inhabit marshes and are very secretive; few Chicagoans other than the most dedicated bird watchers are likely to know them in life. Some rails live in woods or on dry plains; many species are active only at twilight or after dark. Some are highly migratory, but many island forms that normally have few natural enemies have lost the power of flight.

The cranes, a much smaller family with 14 species, include some of the largest birds capable of flight. They resemble herons superficially in having long legs and necks, but when in flight cranes, unlike herons, hold their necks fully extended. Graceful in the extreme, cranes are often portrayed in art, especially in the Orient. They characteristically perform elaborate and seemingly stylized dancing rituals, usually as part of the courtship ceremonies in spring. One particularly magnificent species, the whooping crane of North America, faces almost certain extinction as the total wild population now numbers only about 30 individuals.

Several of the bird families represented in the new exhibit are endemic to tropical America. Especially noteworthy are the trumpeters, the three species of which live in humid lowland forests and are almost wholly terrestrial. Their calls, sometimes heard at night, include deep-toned,

Limpkin (Aramus guarauna)

ventriloquial cries and a prolonged cackle. Sun-bitterns are small heron-like birds restricted to the banks of streams and ponds in tropical forests; drab and undistinguished when at rest, they are revealed as strikingly beautiful when their wings and tails are spread in display. The cariamas of southern South America comprise a relict family most closely related to flightless, crane-like birds that are known only from fossil remains.

On display from across the world are examples of several other remarkable families of this order. The mesites, confined to Madagascar, are medium-sized, terrestrial birds of the forest. Although their well-developed wings appear functional, the birds lack clavicles and evidently are unable to fly. The plain-wanderer of Australia resembles a small quail but is more closely related to rails. As with phalaropes, the male is less brightly colored than the female, and incubates the eggs and raises the young. Similarly, the female bustardquail of Eurasia and Australia actively courts the male, may have several mates, and becomes extremely pugnacious during courtship although it is shy and secretive at other times. The rare and little-known kagu of New Caledonia has a most elaborate courtship display. As kagus are almost flightless they are in danger of extinction because of man and his predatory companions, the dog, cat, and pig.

The several other bird families represented in the exhibit are no less worthy of comment. But better than reading about them is a visit to the Museum's Boardman Conover Hall to enjoy the Synoptic Series in its entirety. This visual survey of the world's avifauna in its infinite variety occupies nine large cases that extend the length of Hall 21. The

Black rail (Laterallus jamaicensis)

550 mounted specimens were carefully selected as most representative of their respective families and of the 8,600 species known to science. By means of this synopsis one can, in a matter of minutes, view the full range of variability in birds, be it of size, form, color, or pattern. Whatever his interests, the perceptive visitor to the Museum and the completed hall can hardly fail to gain a new and lasting insight into the marvels of natural history and the world of birds. ■

HOLIDAY JOURNEYS

DOWN THROUGH the ages the Plant Kingdom has furnished man with food, clothing, and shelter. But Nature also goes beyond these basic necessities to provide man with a wide variety of little "extras," such as sweets and other delicacies for his table. Although many of these foods are available throughout the year, it is during the holiday season that they are most popular.

"Nature's Sweet Tooth," Chicago Natural History Museum's winter Journey, highlights not only some of Nature's most delicious additions to our diet, such as chocolate, honey, and walnuts, but also some of the exotic delicacies popular in other lands, such as pomegranates, betel nuts, and figs.

Boys and girls interested in learning more about "Nature's Sweet Tooth" may pick up their tour directions and the Journey questionnaire at the Museum doors. When filled out, Journey questionnaires should be deposited in barrels provided at either entrance. Awards for successful completion of four Journeys, or multiples of four, are given at special ceremonies in the Museum each spring.

The new winter Journey on "Nature's Sweet Tooth" is available from December, 1964, through February, 1965.

ONCE AGAIN holiday visitors to the Museum are offered a self-guided tour of exhibits showing the plants and animals that lived in Bible times. In the Hall of African Mammals, for example, are the man-eating lions of Tsavo, which fit perfectly the Psalmist's image of young lions roaring after their prey until the sun rises. Other Biblical animals in Museum exhibits are serpents; the domesticated water buffalo and its untamable relative, the Asiatic buffalo; the camel; and the plague locusts that caused famine many times in Bible lands.

Many of the plants that can be seen on the tour have now all but disappeared from the countries of the Bible. Among these are the date palm and the cedars of Lebanon. Other exhibits show the olive tree and the grape.

Supplementing the holiday tour are two Museum publications that give the natural history of such Biblical plants as the bulrush, the "rose of Sharon," and the "lilies of the field"; and tell how dugongs and corals, as well as many other animals, were important to the peoples of the Bible. The booklets are available at the Museum Book Shop for 25 cents each. Directions for the self-guided tour may be obtained at the Museum entrance doors free of charge from December 12 through January 17.

SCIENCE LECTURES

THE MOST difficult, yet most important scientific frontier of our time—the human mind—will be explored in the 1964 Holiday Science Lectures presented at the Museum on December 28 and 29.

Professor Francis O. Schmitt, eminent molecular biologist at the Massachusetts Institute of Technology—who has headed an international research team investigating the enigma of the mind—is the lecturer. His audience will consist of hundreds of outstanding high school students from the Chicago metropolitan area who have been selected by their school principals to attend the lecture series during Christmas vacation.

In morning and afternoon sessions during the two-day series Dr. Schmitt will review the current state of research on molecular organization and cell function, molecular information processing, and molecular neurology. His final subject, "The Science of the Mind: A New Synthesis," sums up present-day knowledge of the mind–body problem. As in previous years, each lecture is expected to stimulate a lively and rewarding exchange of questions and answers.

The Holiday Science Lectures, now in their third year at the Museum, are sponsored by the American Association for the Advancement of Science in cooperation with scientific institutions in major cities across the country. The program is made possible by a grant from the National Science Foundation. Its purpose is to bring to high school students and their teachers a first-hand report of work being done by the nation's foremost scientists. Inevitably, such face-to-face contact not only broadens the scientific horizons of the audience, but communicates to these young people the excitement and inspiration of the scientific endeavor.

In previous years, the students have heard Dr. Rene Jules Dubos, noted microbiologist and pioneer discoverer of

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GABRIEL EDWIN
Assistant Curator, Vascular Plants

SOME USES OF HOLLY

Ilex paraguariensis

Ilex opaca

All of us have seen and admired the shiny, spiny, red-berried wreaths of holly so prevalent during the Christmas season. The species of *Ilex* (the genus of the hollies) most often used for this purpose are *Ilex aquifolium* L., the "English holly," and *I. opaca* Ait., the "American holly." The English holly is the one with the more shiny leaves. Of the 600 species of *Ilex*, these two and about a dozen Asiatic, along with one other species from Florida, are the only *Ilices* with spiny leaves and very large, attractive, red fruit.

Long before the hollies were used for Christmas decorations they were employed ceremoniously by the Druids and in pagan rites.

The early European settlers of what is now Virginia, the Carolinas, Georgia, Florida, and the Gulf Coast states observed the Indians in religious gatherings drinking an intoxicating potion that was also emetic, purgative, and hallucinatory. This liquid, referred to as the "black drink" by these settlers, was a decoction made from the leaves of *Ilex vomitoria* Ait. (known popularly as the cassina, cassine, yapon, yopon, yaupon, youpon, etc.), and *I. cassine* L. (the dahoon). Our forefathers adopted this brew for emetic and purgative purposes. Please note the reversal of the technical and vernacular names.

Today the hard, close-grained, creamy white heartwood of a number of holly species, especially *I. sideroxyloides*, is used for furniture inlays and decorations in the West Indies. *I. opaca* is employed as a specialty wood in the United States. However, the most important economic use of this group is in ornamental horticulture. Over twenty species (principally Asiatic) are grown for both foundation and garden plantings. These are represented by over 800 clonal selections, most of which may be found in *I. opaca*, *aquifolium*, *cornuta*, and *crenata*. Unfortunately, these striking shrubs cannot, with few exceptions, survive in the Chicago area.

Lastly, in large parts of South America, especially Paraguay, Uruguay, Brazil, and Argentina, *Ilex paraguariensis*, known as "Paraguay tea" or "yerba mate," is the preferred caffeine drink.

Ilex cornuta

Ilex aquifolium

Ilex crenata

STANLEY FIELD

(*Continued from page 2*)

Mr. Field and Sara Carroll Brown of Baltimore were married in 1900 and they celebrated their sixty-second wedding anniversary before her death in 1962. Mrs. Field shared her husband's interest in the Museum and was most generous in her gifts. Their two daughters, Mrs. T. Clifford Rodman and Mrs. James A. Cook, one son, Joseph Nash Field, two grandchildren, and six great grandchildren survive. Mr. Joseph Field has served on the Board of Trustees of Chicago Natural History Museum for more than 30 years and is Second Vice President and Chairman of the Building Committee.

Stanley Field sought no honors, but they came to him regardless. The University of Chicago and Northwestern University awarded him honorary Doctor of Laws degrees and he received the Chicago Medal of Merit from the City of Chicago in 1958. The cultural institutions with which he was associated honored him with many forms of recognition.

Although much of Stanley Field's life was devoted to giving to the Museum and to building its structure and collections, he never allowed preoccupation with money and things to take precedence over his concern for people. His advice, his work, and his gifts gained the respect of those who were privileged to be associated with him at the Museum; his concern for them as individuals gained their affection. It was inevitable that the days after his death found the Museum staff with a feeling of great personal and individual loss, but with each person recalling his favorite story of Mr. Field, usually centered on his delightful sense of humor. Chicago and the world owe much to a distinguished gentleman, and his life has created its own monument.

ELW

Cover: Stanley Field and a young cousin, Frederick W. Field
(Photograph courtesy of Cowles Magazines and Broadcasting Inc.)

MUSEUM NEWS

(*Continued from page 6*)

antibiotics, who is Professor at the Rockefeller Institute in New York; and Dr. William A. Fowler, distinguished nuclear physicist from the California Institute of Technology.

This year's Holiday Science Lecturer, a pioneer in the field of molecular biology, has used a wide variety of methods to investigate organization at the colloidal and molecular dimension, including polarization optics, X-ray diffraction, and electron microscopy. At Washington University, where he became Chairman of the Zoology Department in 1939, he and his students made notable contributions to the knowledge of nerve ultrastructure and biochemistry. In 1941 he accepted a call from President Karl Taylor Compton to head MIT's effort to develop a world center of molecular biology. After time out for war research on biomedical problems (particularly wound repair and the treatment of burns) the MIT biology staff, under Dr. Schmitt's direction, started an intensive program of teaching and research in molecular biology. Nerve, muscle, collagen, membranes, fibrils, and other cellular structures were studied by means of all available biophysical and biochemical techniques.

This work led to the organization by Dr. Schmitt, in 1962, of the interuniversity, international Neurosciences Research Program. Mathematicians, physicists, chemists, and engineers joined, in this program, with experts in various biomedical sciences dealing with nerve, brain, and behavior, to investigate the physico-chemical basis of mental processes such as memory, learning, and consciousness. This interdisciplinary attack has given new and fruitful direction to man's ancient yet ultramodern drive to understand the workings of his mind.

For his trail-blazing discoveries, Professor Schmitt was elected to the National Academy of Sciences and has received numerous prizes and awards, including honorary doctorates from five universities here and abroad. He has served as president of several national professional societies and as a member of Federal committees and councils for the support of scientific research.

DISTINGUISHED VISITOR

PROFESSOR Antonio Molina R. of Escuela Agricola Panamericana, Honduras, has come to the Museum to work in the botanical collections. He will be here until the end of the year. Professor Molina is a Field Associate on the Museum staff and associate investigator in a long-term field research program that is being carried on jointly by his institution and the Museum. This program receives important financial assistance from the National Science Foundation.

Professor Molina (right) with Dr. Louis O. Williams, Chief Curator of Botany

Professor Molina brought with him some 15,000 plant specimens. Sets of these specimens will be placed in the collections of the cooperating institutions. Duplicate sets of specimens will be sent to other institutions where there is a special interest in the flora of Central America.

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